Varicose Leg Ulcer.

A typical solitary ulcer, with depressed floor and hard elevated edges, situated on the inner, lower half of the leg, in a man aged 38 years, with varicose veins of 12 years standing. Ulcer healed within two months after the veins were excised. The limb was given one week's rest in bed previous to the operation.

[*See page* 295.

INTERNATIONAL CLINICS

A QUARTERLY

OF

ILLUSTRATED CLINICAL LECTURES AND
ESPECIALLY PREPARED ORIGINAL ARTICLES

ON

TREATMENT, MEDICINE, SURGERY, NEUROLOGY, PÆDIATRICS, OBSTETRICS, GYNÆCOLOGY, ORTHOPÆDICS, PATHOLOGY, DERMATOLOGY, OPHTHALMOLOGY, OTOLOGY, RHINOLOGY, LARYNGOLOGY, HYGIENE, AND OTHER TOPICS OF INTEREST TO STUDENTS AND PRACTITIONERS

BY LEADING MEMBERS OF THE MEDICAL PROFESSION THROUGHOUT THE WORLD

EDITED BY

HENRY W. CATTELL, A.M., M.D., PHILADELPHIA, U.S.A.

WITH THE COLLABORATION OF

CHAS. H. MAYO, M.D.
ROCHESTER

SIR JOHN ROSE BRADFORD, M.D.
LONDON

HUGH S. CUMMING, M.D., D.P.H.
WASHINGTON, D. C.

WILLIAM S. THAYER, M.D.
BALTIMORE

JOHN G. CLARK, M.D.
PHILADELPHIA

FRANK BILLINGS, M.D.
CHICAGO

JAMES J. WALSH, M.D.
NEW YORK

A. McPHEDRAN, M.D.
TORONTO

CHARLES GREENE CUMSTON, M.D.
GENEVA

J. W. BALLANTYNE, M.D.
EDINBURGH

JOHN FOOTE, M.D.
WASHINGTON, D. C.

WITH CORRESPONDENTS IN MONTREAL, LONDON, PARIS AND GENEVA

VOLUME IV. THIRTY-SECOND SERIES, 1922

PHILADELPHIA AND LONDON

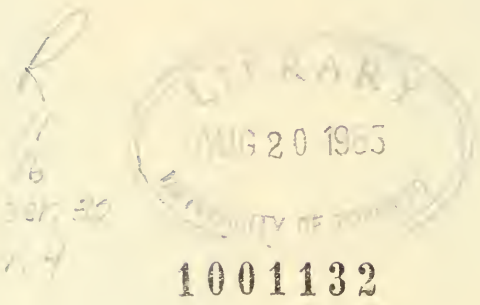
J. B. LIPPINCOTT COMPANY

1922

Copyright, 1922

by

J. B. Lippincott Company



Printed by J. B. Lippincott Company, Philadelphia, U. S. A.

CONTRIBUTORS TO VOLUME IV

(THIRTY-SECOND SERIES)

PAGE

ARNY, H. V., Ph.D., Chairman, Research Committee, American Pharmaceutical Association, New York City 203

BALLANTYNE, J. W., M.D., F.R.C.P.E., F.R.S. Edin., Physician in Charge of the Antenatal and V. D. Departments in the Royal Maternity Hospital; Extern Examiner in Obstetrics and Gynæcology in the Universities of Glasgow and Liverpool 9

BITH, HENRY, M.D., Assistant Physician to the Charité Hospital, Paris, France 89

BOWERS, PAUL E., M.S., M.D., Neuropsychiatrist, United States Public Health Service Hospital No. 24, Palo Alto, California 44

CAHILL, JAMES A., Jr., M.D., F.A.C.S., Surgeon to the Providence Hospital, Washington, D. C. 234

CLOUGH, HARRY D., M.D., Rochester, New York 176

DAVIS, GEORGE G., M.D., Chief Surgeon to the Illinois Steel Company, Chicago 302

DE SANCTIS, A. G., M.D., Attending Pædiatrician to the Post-Graduate Hospital, New York City 225

EDELMAN, MOSES, M.D., Assistant Attending at Post-Graduate Hospital, Babies' Ward; Adjunct Pædiatrician at the Sydenham Hospital; Assistant Instructor in Pædiatrics at the Post-Graduate Hospital and Medical School, New York City 228

EISENDRATH, DANIEL N., M.D., Clinical Professor of Surgery, Rush Medical College; Attending Surgeon, Cook County and Michael Reese Hospitals, Chicago 246

FLYNN, JAMES M., M.D., Rochester, New York 176

FOOTE, JOHN A., M.D., Pædiatrician to the Children's Hospital and Providence Hospital; Professor of Diseases of Children, Georgetown University, Washington, D. C. 40

FRANZ, SHEPHARD IVORY, Ph.D., M.D., LL.D., Director of Laboratories, St. Elizabeth's Hospital, Washington, D. C. 1

GOLDBERGER, JOSEPH, M.D., Surgeon, U. S. Public Health Service, Washington, D. C. 69

HALL, MILTON W., M.D., Major, Medical Corps, U. S. A., Washington, D. C. 123

HELLER, EDWARD P., M.D., Vineyard Park Hospital, Kansas City, Mo. 281

HITCHENS, A. PARKER, M.D., Major, Medical Corps, U. S. Army Medical School, Washington, D. C. 151

Labbé, Marcel, M.D., Professor of General Pathology at the Faculty of Medicine of Paris; Physician to the Charité Hospital, etc., Paris, France 89

McLean, Stafford, M.D., Assistant Attending and Chief of Clinic at the Babies' Hospital; Attending Pædiatrician to the New York Orthopædic Hospital, New York City 244

Mead, Sterling V., D.D.S., Professor of Röntgenology in former Dental Department of George Washington University; Chief, Department of Oral Surgery, Eastern Dispensary and Casualty Hospital, Washington, D. C 257

Norton, N. R., M.D., Physician to the Babies' Hospital, New York City 231

Pardee, Irving, M.D., Physician to the Neurological Institute; Attending Neurologist to the City Hospital; Chief of the Clinic for Neuro-endocrinology, Neurological Institute; Neurologist to St. Mary's Children's Hospital and to the Out-patient Department of St. Luke's Hospital, New York City 223

Robertson, William Egbert, M.D., Professor of Medicine in the Medical Department of Temple University, Philadelphia 78

Rolleston, Sir Humphry, K.C.B., M.D., D.C.L., F.R.C.P., Emeritus Physician, St. George's Hospital, London, England 108

Smukler, M. E., M.D., Assistant Opthalmologist to the Bureau of Health; Opthalmologist to the Northern Liberties Hospital; Assistant at Wills Eye Hospital, Philadelphia 31

Steel, Wm., M.D., B.S., F.A.C.S., Philadelphia 295

Strauch, August, M.D., Attending Physician at the Cook County Hospital, Children's Department; Instructor in Medicine (Pædiatrics) Rush Medical College; Attending Physician at the Central Free Dispensary, Children's Department, Chicago 96

Swan, John M., M.D., Rochester, New York 176

Thom, Burton Peter, M.D., Visiting Syphilologist to the Hospitals of the Department of Correction, Welfare Island, New York City 131

Voegelin, Samuel, M.D., Vineyard Park Hospital, Kansas City, Mo 281

Walsh, James J., M.D., Ph.D., Sc.D., Professor of Physiological Psychology, Cathedral College, New York, and at Marywood College, Scranton, Pa.; Extension Professor, Fordham University, New York City 207

CONTENTS OF VOLUME IV

(THIRTY-SECOND SERIES)

MEDICAL WELFARE WORK

PAGE

MENTAL TRAUMATA, AND THE PREPARATION OF THE MEDICAL PROFESSION TO CARE FOR THEM. By Shepherd Ivory Franz, Ph.D., M.D., LL.D., of Washington, D. C. 1

THE ANTENATAL AND V. D. CLINICS AT THE EDINBURGH ROYAL MATERNITY HOSPITAL. By J. W. Ballantyne, M.D., F.R.C.P.E., F.R.S. Edin., of Edinburgh, Scotland 9

GUARDING THE EYESIGHT OF SCHOOL CHILDREN. By M. E. Smukler, M.D., of Philadelphia 31

WHAT A SOCIAL WORKER SHOULD KNOW ABOUT MEDICINE. By John A. Foote, M.D., of Washington, D. C. 40

CRIME AND INSANITY. By Paul E. Bowers, M.S., M.D., of Palo Alto, California 44

NUTRITIONAL PROBLEMS

A CONSIDERATION OF DEFICIENCY DISEASES: DISEASES RESULTING FROM FAULTY DIETS. By Joseph Goldberger, M.D., of Washington, D. C. 69

SOME COMMENTS CONCERNING VITAMINS. By William Egbert Robertson, M.D., of Philadelphia 78

THE FRENCH AND THE AMERICAN CONCEPTIONS OF ACIDOSIS. By Marcel Labbé, M.D., and Henry Bith, M.D., of Paris, France 89

ALBUMIN MILK IN NUTRITIONAL DISORDERS OF ARTIFICIALLY-FED INFANTS. By August Strauch, M.D., of Chicago 96

CLINICAL MEDICINE

SOME POINTS IN THE DIAGNOSIS, PROGNOSIS AND MEDICAL TREATMENT OF GALL-BLADDER DISEASE. By Sir Humphry Rolleston, K.C.B., M.D., D.C.L., F.R.C.P., of London, England 108

SOME GENERAL CONSIDERATIONS REGARDING THE ETIOLOGY OF THE RESPIRATORY INFECTIONS. By Milton W. Hall, M.D., of Washington, D. C. 123

CARDIOVASCULAR SYPHILIS. By Burton Peter Thom, M.D., of New York City 131

DIPHTHERIA: EPIDEMIOLOGY; INDIVIDUAL SUSCEPTIBILITY AND PROPHYLAXIS, WITH SPECIAL REFERENCE TO THE SCHICK TEST; TREATMENT AND MANAGEMENT OF EPIDEMICS. By A. Parker Hitchens, M.D., of Washington, D. C. 151

A STUDY OF SEVEN CASES THAT PRESENT DIASTOLIC HEART MURMURS. By Doctors John M. Swan, Harry D. Clough and James M. Flynn, of Rochester, New York..... 176

PHARMACEUTICAL RESEARCH. By H. V. Arny, New York City..... 203

THE THERAPEUTICS OF THE PSYCHONEUROSES. By James J. Walsh, M.D., Ph.D., Sc.D., of New York City..... 207

PÆDIATRICS

POLYGLANDULAR DEFICIENCY, WITH HYPERGLYCÆMIA. By Irving Pardee, M.D., of New York City..... 223

A CASE OF AMAUROTIC FAMILY IDIOCY WITH SYMPTOMS SIMULATING TETANY. By A. G. De Sanctis, M.D., of New York City.... 225

A CASE OF PERSISTENT JAUNDICE WITH UNKNOWN ETIOLOGY. By Moses Henry Edelman, M.D., of New York City..... 228

A CASE OF CHRONIC LEAD POISONING WITH ENCEPHALITIS. By N. R. Norton, M.D., of New York City..... 231

METASTATIC ABSCESS OF THE LIVER. By James A. Cahill, Jr., M.D., F.A.C.S., of Washington, D. C..... 234

ANGIOMA. By Stafford McLean, M.D., of New York City..... 244

CLINICAL SURGERY

STONE IN THE KIDNEY. By Daniel N. Eisendrath, M.D., of Chicago... 246

THE DIAGNOSING OF ORAL SEPSIS BY RÖNTGENOGRAMS. By Sterling V. Mead, D.D.S., of Washington, D. C..... 257

THE SCOPE AND USEFULNESS OF WOUND SMEARS TO THE SURGEON. By Edward P. Heller, M.D., and Samuel Voegelin, M.D., of Kansas City, Missouri..... 281

THE TREATMENT OF VARICOSE LEG ULCER. By William Steel, M.D., B.S., F.A.C.S., of Philadelphia..... 295

ATTACHMENT FOR THE THOMAS SPLINT TO KEEP THE FOOT AT RIGHT ANGLES AND ALLOW ANKLE MOVEMENT. By George G. Davis, M.D., of Chicago..... 302

Medical Welfare Work

MENTAL TRAUMATA, AND THE PREPARATION OF THE MEDICAL PROFESSION TO CARE FOR THEM

By SHEPHERD IVORY FRANZ, Ph.D., M.D., LL.D.

Director of Laboratories, St. Elizabeth's Hospital, Washington, D.C.

For practical purposes it is well to distinguish between the mind and the body however much one's philosophy is rigidly materialistic monism. On the other hand, it is also of the greatest practical importance to disregard one's dualistic belief and to recognize that these two aspects of our life are intimately interconnected. At the same time, a great advantage in obtaining and holding an appreciation of the complexities of human life is gained by dealing with concepts that are understandable, even though they may be theoretically untenable. Such an advantage is often obvious through the use of analogies that bring many of the unknown or the poorly understood facts into relation with those that are more familiar and commonplace. It is from this angle that the use of the term "mental trauma" has its value, because it brings the mental into definite relation with the physical, and gives a unified view of the individual who is the subject of medical treatment, and of groups of individuals who require study and investigation.

Those who without too much bias have followed the recent developments in the domain of psychology have noted the more objective standpoint and the prominence of explanations in terms of the physical. The philosophic arm-chair psychology has been largely replaced, and the scientific and utility values of its introspective method have been denied. Following the physical and the other biological sciences, the newer psychology has developed methods of analysis and deals largely with the relations of stimulus and reaction, or with behavior. The individual is looked at as a kind of machine, complex, of course, which undergoes change or which reacts in different ways in accordance with the differences in the environment. Each environmental change acts as a stimulus and

brings about a behavior reaction. In general, it may be stated that the environmental changes with which we are concerned are those that produce an effect upon the neuro-muscular system, directly or indirectly. The difference between the normal and that amount of abnormality which is called a psychosis is a difference in the degree of the reaction. There may be a marked exaggeration in reaction to slight stimuli such as in hyperactivity or in hyperesthesia; there may be a decrease in reaction as is found in catatonics or in some depressions or as accompaniments of defects of the sense organs; or, there may be apparently complete absences of reaction. When they have been sufficiently analyzed, the differences that are supposedly qualitative have been found to be solely those of degree, or quantity, or combination. It is from this behavior standpoint that the so-called mental abnormalities may be most easily understood. This is the case whether one deals with one of the milder manifestations such as a hypochondriacal belief or an hysterical complaint, or with a graver condition which warrants treatment in an institution for the insane.

The criterion of normality in the individual is that he reacts in accordance with his station in life, which includes his education and his other past experiences, and that at least most of his reactions are like those of his neighbors. Conversely for abnormality. Since, however, the behavior which is of importance to the community is "social" behavior, it is on this level that the distinction is made. It is not whether the individual employs a large part of his time examining stars rather than the stock ticker-tape, or that he concerns himself with plants rather than haberdashery, but that in his relations to his family and to the ice-man and the butcher and the janitor, and to the other people with whom he must come in contact, he comports himself in a manner as do most other individuals under similar conditions of stimulation. When he ceases to dress himself in a becoming manner, or when he eats filth, or when he threatens people for calling him names which other bystanders have not been able to hear, or when he continually runs counter to the ideas and laws of the community, he is abnormal. Something has happened which turns the effects of normal stimuli into abnormal channels and

it is this something which is called a mental trauma. It is that which prevents the proper or harmonious functioning of the individual.

It will readily be appreciated that to bring about a behavior abnormality in an individual with what we call a weakened or diseased or predisposed nervous system, a trauma may be less intense or less prolonged than it must be to produce a corresponding effect in the healthy or the well organized. On the other hand, the analogy doubtless holds that most intense and prolonged traumata acting on the most healthful or the best organized system may bring about reactions that are recognized to be abnormal. However, we do not know other than from the effects upon the individual how intensive or massive a trauma has been. Nevertheless, we may extend the analogy farther. We may say that the conditions in infection are paralleled, some persons being able to withstand only a few bacteria while others are relatively immune. Mentally, some withstand the effects of conditions which we find are productive of grave disease in others, but the mental and neurological factors that are called respectively immunity and predisposition are unknown. It appears likely that when subjected to a massive visitation or injection, or to what is called a virulent one, any individual may have the mental counterpart (not the accompaniment, be it understood) of tuberculosis, or typhoid fever, or diphtheria, and that the infection may run a benign or a chronic course.

This conception became better formulated and more widely understood because of the conditions that preceded, accompanied, and followed the great war. During the past half-dozen years mental stresses and invasions have been numerous and there have followed them neuro-psychiatric derangements in both civilians and military. In both classes the traumata that were superficially responsible for mental breakdowns or social maladjustments were the usual order of physical traumata, such as loss of sleep, abnormal fatigue, and bodily injuries and infections. It should be remarked, however, that at periods other than those of war and national disaster these alone have not produced nervous and mental, *i.e.,* behavior, abnormalities in the same proportion. It can be concluded that other etiological, or contributory, factors have played important parts. It was the recognition of this that led to the appreciation of the

importance of mental attitude. The proper mental attitude was spoken of as morale, its lack as demoralization. It was the failure to realize any but the horrible possibilities of war that produced a great increase in psychotic conditions among women during the late spring of 1917, and among men during the first period of the draft in the fall of the same year. It was the inability to withstand the fears incident to trench life and bombardments and night raids and the worries regarding home folks which let the infections and the wounds and the lack of food and sleep twist the individual. When the fears were replaced by ideas of fate or predestination, or of hate, or by those of a future life, or by a high patriotism, campaign rigors became mentally more bearable and a comrade's frightful end was less wearing and overpowering. The knowledge of paid allotments and baseball games and movie and vaudeville shows were powerful antidotes against despair regarding home conditions.

But, army discharge brought about a new series of conditions which had to be met and adjusted to. No longer were food and clothing and amusements supplied, but the ex-soldier had to meet the competition of many of his comrades who were trying to get back into peaceful pursuits, and this was also true of the civilian. War conditions brought a load of situations to which adjustments had to be made, and the cessation of hostilities brought a new train that required other adjustments. It was not a return to an old situation, or stimulus, which could be satisfied with a previously learned reaction, but it was another situation to which the individual had to learn to react in an appropriate fashion.

Those who during the period of conflict had given up farm life to enter the army or to manufacture munitions found themselves in a group life which was foreign to their former life cycles, but to which adjustment was made easy by national feeling. The return to the lonesome farm which followed was not a return to a group of stimuli to which they had learned to react, but both they and the farm had changed and there was a new series of stimuli. Those from the city who became accustomed to outdoor life found on their return that the city as well as they had changed, and there was a different set of environmental stimuli. Ideals had altered and some conventions had disappeared. Business competition and breaking prices

added to the complexity, and the wonder is not that so many but that so few failed to settle down and make good. In some cases the rapid adjustment could not be made and the range of mental troubles runs from imaginary ills to ill-judged ambitions, or from extreme socialism to the extreme shut-in egotism of the dementia præcox group.

It is the period of readjustment through which we are now passing that is most difficult. Life can never be the same as it was, but if it is to be well lived the new conditions must be adequately met. New habits, of action and thought, are needed. The army life cannot be carried over to the new dispensation. Nor can pre-war activities be satisfactory reactions to the changed and constantly changing social environment. But how can the problems be solved? How shall the already psychotic be brought back to the normal or nearly normal level? And, how shall the mental health of the nation be conserved?

The production, or increase, in the tramp and ne'er do well population following our Civil War and our conflict with Spain, with its economic and social disadvantages, must not be permitted to be reproduced. Nor will it be duplicated if there can be created and fostered the generalized belief in the wisdom of the President and of the Congress in the establishment of the special bureau for the care of veterans. Nor will the hobo and many other asocial and antisocial individuals be permitted to go unchecked if there be taken a greater interest in the problems of mental adjustments, mental traumata, and mental conflicts. It is in this that the medical profession has both great opportunity and great responsibility. Let there come a fuller appreciation of the fact that what is worth striving for is a set of reactions or habits, or behavior, that is useful to the community as well as to the individual, and that all, young and old, must not only have a care for their physiological activities but also for their so-called mental reactions. Let it be realized that the whiner or the complainer is the brother of the tramp and the carpet-bagger, let it be realized that to hospitalize him is the same as giving the hobo free access to the larder without adequate work, let it be realized that the psychotic is frequently as curable as the patient with an ingrowing toe-nail, but that also frequently mental surgery

must be performed to bring about a cure or readjustment, and let it also be realized that ignorant sympathy can cause more gold to flow into the sewer than can be mined in a lifetime.

But, this must be said, *viz.,* that in the present state of medical education the medical graduate is not being fitted to undertake the analysis or the care or the treatment of many of the disorders. To use an expression that has recently become popular, it may be explained that the medical graduate must acquire his technic and skill in these lines through "placement training." He may seek and find opportunity in the hospitals for the insane in which the more dangerous patients with psychoses are treated, but the milder manifestations, which have been estimated to make up at least 50 per cent. of the patients of general practitioners (and possibly specialists as well, excepting obstetricians and pediatricians), are learned from books. Nor do we find that the fundamental subjects that are needed for the understanding of mental abnormalities are given sufficient consideration in the regular medical school curricula. In very few of the schools are courses offered in psychology, nor is this subject frequently required as a prerequisite for entrance. At the Government Hospital for the Insane (St. Elizabeth's Hospital) it was found that medical graduates were not prepared for the work, and to prepare them special courses were organized and given each year when a new group of internes was appointed. These courses gradually increased to ten weeks, in which time it was found possible to include much special instruction in administrative and medico-legal matters besides those that are usually grouped among the fundamental and the applied branches of neuro-psychiatry.

The need for preparation of medical officers to care for the neuro-psychiatric patients which are, and will be, under their care has been expressed by the Veterans Bureau, at Washington, and for that Bureau there is now being organized special courses to instruct and to select medical officers for the special work with which that Bureau is invested. Because of the magnitude of the problem that confronts that branch of the Government such special courses are of interest to all medical men, and it is worth while to give in brief an outline of the course as planned. It is obviously impossible that one instructor should know enough about all branches of the work

to undertake the didactic and clinical teaching connected with such a course, and it may be stated that both in the construction and in the giving of the course there will be brought together the ideas of many of the most eminent neurologists and psychiatrists in the eastern section of the country. On the part of neurologists and psychiatrists who have been appealed to there has been a willingness to give of their valuable time, and an enthusiasm to do what they can do for the welfare of the Government and the country. This is added evidence of the social service for which medical men have been noted. At the same time others more intimately associated with the fundamental and auxiliary subjects have been equally liberal and have promised coöperation to the fullest extent.

When the broader aspects of mental and social adjustments are considered, it is apparent that any course that pretends to be reasonably comprehensive must deal with a number of subjects that are frequently missing in the clinical courses that can be provided for the medical student. It is because of the time allowance, four months with daily lectures, demonstrations, laboratory and clinical exercises, that this is now made possible, and the following list of the more important topics represents what may be considered to be a unique feature of this work. Excluding those topics that are recognized to be of prime importance because of their immediate application value, such as systematic clinical neurology, endocrinology, the congenital mental disturbances, the acquired psychotic manifestations, there will be reviews, by eminent men in the respective fields, of (*a*) the anatomy and (*b*) the physiology of the nervous system, of (*c*) neuro-pathology, of (*d*) serology in its applications to neuro-psychiatric conditions, and of (*e*) neuro-surgery. Special attention will be given to the methods and indications of the special therapeutic measures that are to be used: (*f*) psychotherapy, including rest, suggestion, and psychoanalysis, (*g*) hydrotherapy, (*h*) electrotherapy, (*j*) physiotherapy, (*k*) occupations, bed-side and vocational. Both (*l*) the chemistry of nervous tissues and (*m*) the methods and meanings of metabolism changes will be discussed; (*n*) psychology, normal and abnormal, and (*o*) tests for general intelligence and special aptitudes will be included as well as the usual methods of mental and neurological examinations. A special

set of talks (*p*) will be given on the relation of non-neurological diseases to the activities and disturbances of the nervous system; (*q*) heredity studies, (*r*) statistics, and (*s*) general problems and relations will also be considered. It is apparent that since commitment and care of the psychotic most frequently reside under the authority of the courts the (*t*) medico-legal aspects of the work should not be neglected. The last matters will be dealt with both from the general standpoint and also from that of special governmental laws and regulations.

At first sight it may appear that the diversity of topics will tend to lead to superficiality rather than proficiency, but that it will lay a broad and solid base for future building can be expected. It will serve to bring home the fact that there is a unity in the neuropsychiatric conditions, which in recent years have tended to separate into the specialties, neurology and psychiatry, and it will also serve to prevent one-sidedness and a satisfaction in diagnosis. At the same time the provision for subsequent additional intensive instruction for the students in the main clinical branches that are required will serve to offset any possible deficiency, and such additional courses can be then attended with considerably more profit.

One of the most interesting by-products to the medical profession is that the Federal Government now recognizes the importance of having well-trained and broadly-trained men who shall deal with the behavior disturbances of those who are its wards, and that in place of technical diagnosticians the effort is being made to produce for its own service those who shall be able to deal with the varied difficulties of mind and body, who shall be able to understand the effects of mental traumata as well as those of arms and legs, and who shall be able to help the whole country because of their broad training in the problems of mental reconstruction.

THE ANTENATAL AND V. D. CLINICS AT THE EDINBURGH ROYAL MATERNITY HOSPITAL*

By J. W. BALLANTYNE, M.D., F.R.C.P.E., F.R.S. Edin.

Physician in Charge of the Antenatal and V. D. Departments in the Edinburgh Royal Maternity Hospital; Extern Examiner in Obstetrics and Gynæcology in the Universities of Glascow and Liverpool; etc.

The Antenatal Department of the Edinburgh Royal Maternity Hospital forms an essential part of the Edinburgh system of Mother and Child Welfare work. Within its walls are carried on four important kinds of obstetrico-pædiatric activity, each of them aiding in the preservation of maternal and infantile health and life in the City. These are as follows:

First, there are the prematernity or antenatal beds for the treatment of the diseases of pregnancy and for the supervision and correction of the morbid conditions arising in pregnancy which may bring an element of danger into the labor of the mother and the birth of her infant. There are ten of these beds with others in reserve should need arise for extension. They constitute the oldest part of the Prematernity System in Edinburgh or anywhere else, having been instituted in 1901. The present year marks the attainment of the majority or coming of age of the Antenatal or Prematernity Movement in Obstetrics and Pædiatrics.

Second, there are the Antenatal Clinics for the supervision of the health of expectant mothers during the whole period of their expectancy, for the detection and correction of such ailments as can be put right without treatment in hospital, for the separation of cases of venereal disease in gestation and their transference to the V. D. Department, and for the discovery of cases of disease in pregnancy requiring admission to the antenatal beds already referred to. In many places the Antenatal Clinics constituted the first part of the Prematernity System to be established, the beds being added later, if indeed they have been added at all. Here in Edinburgh the Clinic

* The substance of two Clinics given during the Course in Diseases of Children of the Edinburgh Post-graduate Courses in Medicine on the 7th and 8th of August, 1922.

was not set up as a separate and specialized part of the work till 1915, although it had been in use in an irregular form for some years before that. It has been proved by experience that Antenatal Clinics without antenatal beds are very disappointing in practice however attractive in theory; one is constantly finding one's self in a *cul-de-sac,* for the really important case is that of a disease of pregnancy detected at the Clinic and of so serious a nature as to require treatment in hospital. No prematernity system is complete without antenatal beds.

Third, there are the specialized V. D. Clinics for the diagnosis and for some part of the treatment of the venereal diseases complicating pregnancy, labor and the puerperium, and affecting the newborn infant. These are usually held in the mornings while the ordinary Antenatal Clinics meet in the afternoons. The full treatment of syphilis and gonorrhœa is not carried out in them, but transfusions and swabbings are done and much useful work is accomplished.

Fourth, come the beds for the venereal disease cases requiring residential treatment. There are fourteen of them with, as in the case of the antenatal ones, some in reserve. In them all the v. d. labors are nursed in the days of the puerperium; and there are cots for the babies. Some pregnancies too are cared for in these beds. There is a small labor ward for the deliveries of these infected cases. The whole of this work is carried on in wards set apart, and every precaution to avoid infection is taken. Two purposes are served: The infection, syphilitic or gonorrhœal or both, is treated; and any obstetric difficulty, such as narrow pelvis, is dealt with.

The four parts of the work in the A. Department, for under this name all the activities are grouped, constitute portions of the whole system of mother and child welfare. Each is, as it were, a segment in the circle of preventive and curative means which go to the saving of maternal, fœtal, and infantile lives, to the amelioration of maternal suffering, and to the lessening of intranatal and neonatal disease and deformity. The expectant mothers are invited to attend in the first place for their own sakes and in the second for their infants' sakes; but of course there is overlapping, for the curing of any disease or irregularity of the mother necessarily is good for the baby, and the

bringing of living and normal infants into the world cannot but act beneficially upon their mothers.

Many instances might be given; but at this stage a few must suffice. For example the curing of a case of hyperemesis or of chorea gravidarum is of great benefit to the expectant mother; but it is also of great value to the young organism, for if not carried out, abortion may result, with, of course, the loss of a fœtal or an embryonic life. Again, the rectification of an abnormal position or presentation of the fœtus in utero in the later weeks of pregnancy will give the mother an easier labor, and it may also save the child from being born asphyxiated or with hemorrhages in its cerebral ventricles which produce disease in infancy. Again, the curing of a gonococcal cystitis and vaginitis in an expectant mother will relieve her of a painful and troublesome disease, and it will greatly lessen the risk of her child being born with ophthalmia neonatorum. The treatment of albuminuria in pregnancy will remove the impending catastrophe of eclampsia and the accompanying danger to the infant of stillbirth. To summarize: Seven pieces of preventive work are being daily done in the A. Department. There is (1) the prevention of abortions, (2) of stillbirths, (3) of premature labors, (4) of difficult labors, (5) of dangerous labors, (6) of injured new-born infants, and (7) of diseased new-born infants. Instances of several of these useful preventive measures are at present in the wards.

THE PREMATERNITY OR ANTENATAL WARDS

As has been said already the prematernity or antenatal beds are an essential part of the system of preventive obstetrics. With them cases of disease in pregnancy detected at the Antenatal Clinics are ensured further and often successful treatment; without them the whole process of relief of suffering and prevention of death may be gravely impeded if not actually suspended. Further, these beds are to be ear-marked for pregnancy cases; they are not to be used for ordinary puerperal patients and occasionally diverted for the purpose of accommodating expectant mothers; they are to be regarded as the possession of sick expectant mothers and never to be given to any other patients. On such terms alone can an Antenatal Department be satisfactorily conducted.

At the present time nine out of ten beds are occupied. It is found desirable in practice to have one bed free for emergency cases, especially for those suffering from pre-eclamptic phenomena or from grave hyperemesis. To-day there is only one really serious case under treatment, the others being apparently slight aggravations of the symptoms of pregnancy or presenting anomalies in process of correction in order to render the labor easier when it comes on.

In the two-bedded ward is Mrs. T., a woman of 25 years, who had one previous labor which terminated at the seventh month and was complicated by eclampsia; the fœtus was macerated. She is now pregnant again and has reached the third month (her last menses was at the end of April). Her doctor a few weeks ago detected a trace of albumin in the urine. He placed her on a diet of milk and gave her other treatment in her own home; but the symptoms continuing he sent her in to the A. Department for supervision and treatment. Her blood-pressure was high (200) when she was admitted, and preparations for performing venesection were made; but under treatment (strict milk diet, enemas, salts, etc.) the pressure fell, the headache was easier, and the vomiting ceased, and so the blood-letting was postponed. The quantity of urine varies from day to day; on admission it was 22 ounces in the 24 hours; now it is 39 ounces. It has a specific gravity of 1030 and is acid, and there is still a trace of albumin. I anticipate that this patient will be under supervision for some time. The problem here is the carrying on of the pregnancy with safety to mother and fœtus. To induce abortion now would be to acknowledge defeat. With her past history of eclampsia she is emphatically a case for the Antenatal ward. [At her own request she was allowed to go to her home in the country on the 18th of August, where she would be under the care of her medical attendant; the blood-pressure was then 143.]

The patient in the other bed in this ward has suffered from epilepsy since her girlhood. She is now 25 years old and this is her fifth pregnancy; her four previous labors were all instrumental. Partly because of the epilepsy and partly on account of her previous obstetrical history she was admitted to the A. Department. Her epilepsy is neither better nor worse in pregnancy. She is almost at full time. Since her admission (a few days ago) she has had no fit. She has

been given a tonic mixture of iron, arsenic, and strychnine. Obviously she is safer here than in her home, for here she can receive all needed medical help in the event of fits supervening. [Note: She passed into labor on the following day (August 8); was sent over to the main part of the hospital; and was safely confined of a living infant without the aid of forceps and without fits.]

In the three-bedded ward all the beds are occupied. The first patient, Mrs. B., is a primipara, 21 years of age. She was seen at the Antenatal Clinic suffering from weakness, a persistent cough with bronchial sounds over the bases of the lungs, and a trace of albumin in the urine. There was a suspicion of tuberculosis, and she is obviously anæmic. Her confinement is due in the beginning of October. She is receiving treatment for the chest condition, for the anæmia, and for the albuminuria; and already she is much better. The obstetrical conditions are normal. [Note: Seven days later, on August 14th, she was allowed to go home, with instructions to report herself at the Antenatal Clinic from time to time. She was delivered of a healthy child on September 10th, and both mother and infant did well.]

In the next bed is Mrs. D., a iii-para, 25 years old. Her first labor was accompanied by eclampsia and the birth of a dead fœtus. Her second labor was normal and a live-birth. She is now seven months pregnant, and as she was found at the Antenatal Clinic to be suffering from some pre-eclamptic symptoms and had a trace of albumin in the urine she was admitted. She was dieted, got enemas for constipation and vomiting, and had saline purgatives. The albumin has disappeared. Her labor is not due for 2½ months (October 19). The presentation of the fœtus on her admission was vertex; during her stay it has become a breech; it is meanwhile being left a breech, but, of course, version will be performed nearer confinement if it be needed. With her past history of eclampsia this patient requires watching; but the prognosis is not unfavorable if she be kept under supervision. [Note: A few days later (August 12th) she was allowed to go home as she was free of symptoms; she returns at frequent intervals for urinalysis and supervision, and she continues the strict diet at home; she was delivered of a healthy child at full term.] The patient, Mrs. H., in the third bed is interesting from a purely obstetrical point of view. She is 25 years old

and is pregnant for the third time. The two previous pregnancies ended in normal labors. It was found at the Antenatal Clinic that the fœtus was presenting by the breech. She was asked to come into the antenatal beds for a few days, where cephalic version was performed. Pads were applied to the sides and a tight binder fixed in position round the abdomen. The infant is now lying in the vertex presentation. The confinement is due in ten days or so. [She had a normal labor on September 1st.] For rectification of malpresentations and malpositions (occipito-posterior positions) the antenatal beds are most useful, for, when manual reposition fails, the treatment by abdominal towel pads applied with the patient in bed usually succeeds at once.

In the four-bedded ward the cases are comparatively uninteresting now, although on admission each had its special necessities. Mrs. M., 40 years of age, has had six previous labors and one miscarriage. She threatened to abort three months ago, but the danger was averted. She is now near the full term (August, exact date uncertain), and as she was found at the Clinic to be suffering from vomiting, from pain in the side, and from swelling of the feet, and as the fœtus was a pelvic presentation, she was admitted to the antenatal beds. Soon after admission spontaneous version occurred and the presentation became vertex. As she had had an abortion and a threatened premature labor her blood was tested, but the Wassermann reaction was negative. Under regulation of the bowels with enemata and cascara sagrada (on alternate days) and the taking of small doses of hydrocyanic acid the vomiting has ceased and the pain in the side and swelling of the feet have disappeared. She is practically well, but is remaining in the ward as her confinement is close at hand and as her age is 40. [She was delivered of a healthy child at full term.] The patient (Mrs. A.) in the next bed is a iii-para, aged 26, whose confinement is due in ten days; she was found at the Clinic to be suffering from vomiting. Under similar treatment to that given to Mrs. M., her condition has greatly improved. In her case the Wassermann reaction was also negative. She will be sent over to the main block of the hospital when her pains come on. [She went to full term and had a healthy child.]

The third patient in this ward, Mrs. W., aged 21, is a primipara.

There is some doubt about her menstruation, but her confinement is provisionally expected in the first week of September. This is her fourth time of residence in the ward. She has had a trace of albumin all the time of her gestation. She has also from time to time suffered from swelling of one leg, from varicose veins, from vomiting, and from pain in the side, and for these reasons she has been admitted in April, in May, in July, and again now in August. She has on each occasion benefited greatly. Her home conditions are very unfavorable, so that the mere being in hospital is an advantage to her. [She improved greatly and was delivered of a healthy child.] The fourth patient (aged 26) has had one previous labor and one miscarriage. She came to the Clinic from some distance away, and as it was decided to test her blood she was taken in for a few days. The Wassermann reaction has turned out to be negative, but she will remain here (as her confinement is almost due and her home is so far away).

These cases demonstrate the usual activities of the Antenatal Wards, but, as can be imagined, the variety of conditions dealt with is wide and maladies requiring much more diversity of treatment than those at present under management may be met with. The hyperemesis cases offer good examples of the possibilities rendered by the Department. The patient gets, in the first instance, the benefit of hospitalization: there is regularity in the life of the wards; there is a certain degree of discipline, often of value in the case of women who have come to hold on to the basin for fear of sickness; there is attendance to every item in personal hygiene. At first no food is given by the mouth, and at the same time constant precautions are taken to prevent oral sepsis. A system of enemata is introduced to ensure the thorough emptying of the rectum and colon; time is taken over this, the long tube is used, and irrigation is carried out. Very often these measures alone are sufficient and at the end of twenty-four hours a little simple food may be given by mouth and retained. The simple fact that the food is not prepared by the woman herself is a help. Meantime the patient has been thoroughly examined. If a uterine displacement is found, it is corrected; if it be a retroversion or flexion, it is replaced by position and a pessary introduced; if it be an anteflexion, an abdominal binder is applied. Cer-

vical catarrh if present is attended to. At the same time the presence of such grave conditions as ectopic pregnancy or hydatidiform mole is looked for and excluded. In grave cases, suggesting the toxæmic type, the total urine for the twenty-four hours is sent to the Laboratory for the estimation of the ammonia nitrogen coefficient. The beds also enable experiment to be made with new remedies, such as corpora lutea extract. Induction of abortion is never easy to be decided upon.

The attitude of the Department towards induction of abortion is that it spells failure: The sacrifice of a fœtal or embryonic life in order to save the mother's life cannot be regarded as a complete success even when the mother recovers, and of course when both are lost it is a twofold tragedy. Our therapeutic resources are not yet complete enough to guarantee success in every case, but the number of instances in which abortion has to be done is gradually diminishing. During the past two years dozens of cases of excessive vomiting have been dealt with in the Department and in only two was induction of abortion seriously debated. In one of these it was carried out. The patient was a woman of 41, pregnant for the fifth time; in three of her previous pregnancies she had had induction performed for hyperemesis, and in only one had labor occurred at the full time with a living infant; on the present occasion she was admitted after vomiting had been going on for several weeks, and after various means had been tried and emaciation had set in. There was also a suspicion never clearly established of the presence of pyelitis. The Wassermann reaction was negative, but there was gonorrhœal vaginitis. Her condition was considered so threatening that induction at the third month was carried out. She was discharged well; but let it be noted that the total result of her five pregnancies was one living infant. In the case of the other patient referred to, a woman of 22 and a i-para, the cause of the excessive vomiting was presumably a retroflexed and fixed uterus. She had been seriously ill and had been under treatment for some weeks before she entered the Department; she was dangerously weak and much emaciated and although she was kept alive by nutrient enemata and rectal salines and other measures no improvement could be recorded; induction was decided upon but accidental circumstances prevented its

performance on the day determined, and, as improvement then set in, it was never done. The adhesions in the pelvis appeared to stretch and the uterus grew up into the abdomen. This was in February of the present year, and a few days ago she gave birth to a living child. Obviously there is still something to be learned as regards prognosis and treatment in cases of hyperemesis. Antenatal Wards afford a magnificent means of learning.

THE ANTENATAL CLINIC

The Antenatal Clinic is now a well-established part of the prematernity system in many places. It is unnecessary to describe its working in detail; but there are some matters to which reference may be made.

In Edinburgh the Clinic is supplied from the following sources. Patients coming to book a bed for confinement in the hospital are all sent down to the Clinic for examination; other pregnant women are sent to the Clinic from the smaller Preventive Clinics and from Dispensaries; some come direct on the recommendation of Health Visitors; some are brought by the Salvation Army Officers from their Rescue Shelters; and some are sent by medical practitioners. Infected cases also pass through the Clinic on their way from the V. D. Department of the Royal Infirmary to the V. D. beds reserved for them in the Maternity Hospital. Between eight and nine hundred patients a year have thus come to the Antenatal Clinic in 1920 and 1921; and this year the number will probably exceed 1000. About a third of all the patients dealt with by the Royal Maternity Hospital thus pass through the Antenatal Clinic; and every year they are coming at earlier dates in pregnancy and are seen more frequently. Of all the births occurring in Edinburgh (extended), amounting to some 9000 in the year, about one-ninth get antenatal supervision through the Clinic.

The accommodation is unfortunately very limited, consisting of three small rooms and a lavatory, with, recently, a small laboratory for bacteriological and pathological research; but the medical and nursing staffs are sufficient, and a monetary grant from the Town Council Health Committee and the Scottish Board of Health greatly facilitates the financing of the undertaking.

The main principles upon which the Clinic is worked are as follow: The ideal to be reached in practice is to get the patients to come early in pregnancy, at any date after the missing of the first menstrual period; in fact the attempt is beginning to be made to "tryst" the patients at the close of the puerperium, on the principle that in the puerperium of the past labor begins the antenatal supervision of the next pregnancy. Great emphasis is laid upon the return visits to be paid by the expectant mothers; the exact date is fixed, and in the event of her non-appearance the Town's Health Visitors call at the the patient's home. At the same time each woman is encouraged to return sooner than the fixed date should she feel ill or even should she be anxious without being actually ill. Each patient is given a very small pamphlet entitled "Hints to Expectant Mothers;" it is so short that it can be read in the waiting-room; it is wholly practical; and it is absolutely simple in its phraseology. It points out the danger signals in pregnancy, but it also insists that with adequate supervision the risks of disaster and the chances of discomfort are reduced to a very small amount. No patient who is progressing normally is allowed to go away from the Clinic without being assured of her well-being; means are taken to aid her if there is anything abnormal and even the slight inconveniences of gestation are attended to. The welfare of her unborn infant is always referred to, and she is shown that the Staff has a real interest in both mother and child.

The technic of the Antenatal Clinic is summed up in a sentence; the thorough investigation of the obstetric, the medical, and even the surgical conditions of the pregnancy, the continued supervision of the woman throughout the whole course of the gestation, and the putting right of anything which goes wrong, either at the Clinic or in the Antenatal Wards.

The details vary in different Clinics, but the points of difference are not essential. In Edinburgh the urine is tested before the patient comes to the consulting room. The interrogatory deals with the past history in so far as it has any bearing upon the present pregnancy and forthcoming labor; in the case of the multipara it is of course of some length, for it is most important to know exactly what happened in previous pregnancies. The family history and that of the hus-

band are not neglected. In the questionnaire used most of the common troubles of pregnancy (vomiting, constipation, piles, discharge, pressure symptoms, abdominal pain, urinary difficulties, varicose veins, etc.) as well as those of the pre-eclamptic state are named; their presence is indicated by underlining. The physical examination includes that of the heart, lungs, breasts, and teeth, but special reliance is placed upon abdominal palpation. The height of the fundus uteri is determined and compared with the menstrual history in order roughly to guage whether the rate of growth is normal or not. The interspinous and intercristal diameters are measured and sometimes the external conjugate as well; in this way an early hint is got of pelvic deformities. The presentation of the child is determined by palpation, the various grasps (fundal, lateral, Pawlik, etc.) being used to discover the locality of the head and breech, and the anterior or posterior position is noted. Abdominal auscultation is practiced; the position, rate and character of the fœtal heart beats are recorded. The presence, strength, and position of fœtal movements are also observed. Special attention in the later months is paid to the possibility of pushing the fœtal head into the brim of the pelvis. It is not customary to make a vaginal examination or to measure the diagonal conjugate on the patient's first visit to the Clinic; but it is always done on the second occasion, and it is done on the first when the pregnancy is far advanced or when there is a history of difficult labors or the presumption of labor having begun. The history of symptoms pointing to syphilis or gonorrhœa should always lead to an immediate inspection of the vulva; in their absence this also may be postponed till the second visit. In some cases the patient is told to return next morning for blood examination (Wassermann, blood count, etc.), the taking of smears of vaginal discharge, etc. At the close of the first visit to the Clinic the patient is told the probable date of her confinement; she is reassured as to her general condition if all is found to be well; if any abnormality is present measures are taken to put it right and very often its nature is explained to her and she is told what to do or what to avoid doing; she may receive some medicine; and she is given the exact date of her return visit.

At the patient's second visit an internal examination is made.

The vaginal and bimanual examinations are necessary for by their means alone abnormal conditions affecting the cervix, the vagina, the rectum and lower colon, and the internal pelvic measurements at the brim and outlet and in the cavity can be ascertained. In the case of a small pelvis the diagonal conjugate is measured and the true conjugate is deduced from it, and the future management of the labor is determined. The full state of the rectum may be recognized, and an enema may be recommended and even administered before the patient leaves the Clinic. From the state of the os the commencement of labor may be detected and the patient sent to the labor ward. And so on; a hundred and one matters may be dealt with and decisions made. It is customary at some Antenatal Clinics to omit internal examinations save under very exceptional circumstances and to trust entirely to abdominal palpation; it is not safe, neither does it lead to accuracy of diagnosis nor prognosis. At every visit the urine should be analyzed, at any rate for albumin. The Edinburgh Clinic yielded ample proof of the necessity for repeated urinalysis in 1921: Out of over eight hundred patients seen, there were 254 who had albuminuria (most of them only a trace) and in 104 of them the albumin was discovered on the second or some subsequent visit. At every visit also the presentation and position should be redetermined, the fœtal heart listened to, and new symptoms or signs noted. In the primipara without urgent symptoms a fortnightly visit in the last three months is requisite for safety, and much oftener on the emergence of such a danger signal as albuminuria or eye changes. In the multipara with a good past record and no present troubles one visit to the Clinic in a month will suffice.

The benefits to be derived from the Antentatal Clinic are many and varied. In the first place the patient receives comfort from the complete examination and the information that so far all is well with her; and comfort here has its old etymology of strength. She is reassured and goes forward to the close of her pregnancy and the testing time of labor with renewed confidence. She may have been worrying about herself, not understanding her own feelings, misreading her sensations, and becoming depressed in mind and fearful of the future; she leaves the Clinic in good spirits again and with

a happy outlook. The change can be seen in her face and heard in the tones of her voice.

These, however, constitute only the subjective benefits derived from the Clinic; there are medical and obstetrical advantages of a more important kind. Diseased conditions complicating pregnancy have been recognized and their treatment initiated. To name only a few one thinks of pyelitis, albuminuria, chorea, hyperemesis, anæmia, heart disease, lung disease, pyorrhœa, hæmorrhoids, and the almost constant constipation. Diseased conditions of pregnancy are also diagnosed and prepared for; such are hydramnios, displacement of the uterus (retroversion, prolapsus, pendulous abdomen and anteversion), threatened miscarriage, ectopic pregnancy, hydatidiform mole, impending hemorrhage from placenta prævia or separation of the afterbirth, premature labor, postmature labor, and antenatal death of the child. Purely obstetrical difficulties are foreseen and legislated for; the narrow pelvis is measured, its type discovered, and the plan of management outlined; the size of the fœtus is estimated and contrasted with the maternal pelvic measurements even when the latter are known to be normal; malpresentations and malpositions of the fœtus and its head are found out and means taken (by manual or postural methods or by the application of pads and binder) to correct them; twins are provisionally if not certainly diagnosed and the obstetrician is forewarned so that he may be forearmed; and the presence of a fibroid tumor of the uterus or of a cystic growth of the ovary is detected early enough to allow a reasoned opinion to be formed as to the best method of dealing with it. These are some of the anomalies detected at the Clinic, and rarer conditions such as appendicitis, intestinal adhesions, gastric ulcer, tuberculous ulceration of the bladder, stone in the kidney, cerebellar tumor, herpes zoster, and phlegmasia alba dolens, have not been unknown at the Edinburgh Clinic. A double vagina has been discovered, a fœtal heart murmur has been heard and confirmed later, and hydrocephalus has been strongly suspected and found to be so. Of course syphilis and gonorrhœa are always looked for, sometimes found, and promptly transferred to the V. D. Department. Other results arising from the work done at the Antenatal Clinics might be named, but the ones referred to above will serve to show its far-reaching powers. It may

be added that excluding the venereal cases the patients supervised at the Clinics in 1921 were delivered of only 5.9 per 1000 stillbirths, as compared with rates of 47.8 per 1000 for the whole city of Edinburgh and 56.3 for the whole hospital; in other words there were only 4 stillbirths in the 678 supervised pregnancies. The venereal cases (171 in number) revealed a very different state of matters, as will be seen immediately, although even amongst them supervision and anti-venereal treatment had an immense effect.

THE VENEREAL DISEASES WORK

As was intimated at the beginning of yesterday's Clinical Lecture the V. D. work in the A. Department consists of two parts, that carried on in the wards and that done at the V. D. Clinics. The two parts however, may be conveniently described together for they overlap and often it is simply a question of severity of symptoms which decides whether the expectant and infected mother be treated at the Clinic or in the wards.

The sources from which the patients come are chiefly four. Many are discovered among the women attending the Antenatal Clinics of the Department; and the discovery is usually made from one or more of three indications. These are (1) from the previous obstetrical history, *e.g.,* abortions, premature labors, stillbirths; (2) from obvious signs of syphilis seen at the Clinic, *e.g.,* chancre, secondary sores, rashes, etc.; (3) from the presence of a vaginal discharge associated with urethral and Bartholinian signs in cases of gonorrhœa. A second important source of supply is the V. D. Department in the Edinburgh Royal Infirmary; pregnancies and labors are not dealt with in that Institution and consequently the town when initiating its V. D. Prevention and Treatment Scheme arranged with the Royal Maternity Hospital to accept responsibility for the management of all pregnant women infected with syphilis or gonorrhœa or both during their gestation, labor and puerperium, as well as of their infants. Such patients are sent on from the Infirmary. A few also come from the other Antenatal Clinics (preventive and curative) in the City. A third supply is the Maternity Hospital itself: Sometimes venereally infected cases are taken in for delivery in the main block of the hospital without their infected nature being discovered till after

or during delivery; they are then transferred to the Department. It is from this source that the most difficult cases come to the Department; had they been detected earlier they would have received treatment, both obstetric and anti-venereal, but as it is they come with all sorts of pathological possibilities and give very unsatisfactory results. The routine making of a Wassermann test of the blood from the cord in every labor in the main block of the maternity would undoubtedly comb out a few more unsuspected cases. A fourth source of supply is the general practitioner in the city or in the surrounding country districts.

SYPHILIS

As soon as a syphilitic pregnant patient is seen at the Clinic or admitted to the wards her treatment is commenced, and the same is done as soon as the Wassermann is returned as positive in a suspected case. The drugs used are novarsenobillon (914) and mercury. There is, of course, a risk of producing nephritis in the expectant infected mother; but this can be reduced to a minimum by examining the urine every day for albumin and by carefully regulating the dose. In some Clinics the risk is regarded as so great that novarsenobillon and mercury are never given together; but it has not been found necessary to proceed to this extreme precaution in the Department. If on any day a trace of albumin is detected in the urine the mercury is stopped for a week and then begun again. An aperient is always administered the night before the intravenous injection is given, and the patient has a light breakfast two or three hours before the injection is made. If she is not residing in the wards she is kept in the building for two hours after the N.A.B. injection and her pulse and temperature are taken before she is allowed to go home. In only two instances has jaundice developed and it was slight in both; there has been one severe case, but it was that of a woman who had been treated outside and all precautions had not been taken. The dosage of the novarsenobillon is an important matter. The woman is pregnant and the interests of the unborn infant have to be considered. The dose to begin with is .15 gram and this is gradually increased up to .6 gram. An injection once a week is given and eight such injections constitute a course of two months. The total amount given in a course varies from

3.5 to 4 grams. The mercury may be given intramuscularly in oil, and for a time Squire's Cream was thus administered in the Department; but now the routine is to give hydrargyrum cum creta (1 grain twice or thrice daily) by the mouth in the form of a pill. The appearance of stomatitis is always carefully watched for, and hygiene of the mouth is insisted upon.

At the end of a course of N.A.B. and mercury a stoppage in treatment is made for a week or ten days; if the patient is not near full term the intermission may be for two to four weeks. Then a Wassermann is taken. If it was positive before and is still positive, a second course is naturally given; but even if it is now negative it is still highly desirable to give a second course. Some syphilologists have stopped the treatment at the eighth month on account of the alleged risk of predisposing to post-partum hemorrhage; but in the Department the N.A.B. and mercury have been safely continued right up to delivery. At labor a Wassermann is done upon the blood got from the cord; if it is positive, then the baby gets N.A.B. intramuscularly and hydrargyrum cum creta by the mouth; if it is negative then the baby is given mercury alone. The dose of the novarsenobillon for the baby is from .01 gram to .05 gram in the first course. At the end of the puerperium the mother and child are transferred to another V. D. Centre where they are kept under treatment or supervision till all symptoms have disappeared. The mother is also urged to report herself early at the Clinic if she again becomes pregnant.

The results both for mother and child are excellent when the intravenous injections are begun early enough in pregnancy to warrant two courses being completed before labor comes on. Two patients now in the wards form a striking contrast. Both of them were in the Hospital a little more than a year ago and both gave birth to macerated fœtuses; soon afterwards both became pregnant again; one willingly underwent the treatment with intravenous injections of novarsenobillon and has now a healthy child a few weeks old; the other did not come for any treatment, but returned in labor a few days ago and gave birth again to a dead macerated fœtus. Of course in dealing with expectant mothers suffering from syphilis the obstetric aspects of the case must not be lost sight of. In the presence of

active untreated syphilis the induction of premature labor for, say a contracted pelvis, is not attractive. But if the patient has had two courses of N.A.B. and mercury the obstetric needs of the case may safely be decided without reference to the former infection. For instance, there was a patient who had two courses of treatment here a year ago; as a result the Wassermann was persistently negative; the true conjugate of her pelvis was below 3 inches; in her case the speaker performed Caesarean section with the best results for both mother and infant, and regards the outcome as a triumph of the combined antenatal supervision and anti-venereal treatment of the patient. If pregnancy cases infected with syphilis are seen early enough there is no reason why the most hopeful prognosis should not be given.

GONORRHŒA

The diagnosis of gonorrhœa in pregnancy is not always easy, and sometimes one has to take it for granted and proceed with treatment. There are three means which may be employed in reaching a conclusion, clinical, bacteriological, and serological. In the Department most reliance is placed upon the clinical grounds of diagnosis. In this respect, as well as in others, the Department has been fortunate in having as Resident Medical Officer, Dr. May Roxburgh, fresh from six months' experience in charge of the Women's V. D. work in the Royal Infirmary.

The clinical indications of gonorrhœa in the pregnant patient are eight in number: (1) Inflammation of the urethra and Skene's glands, pus being expressed by pressure through the anterior vaginal wall; (2) swelling of Bartholin's glands; (3) the expression of pus from Bartholin's glands on pressure; (4) inflammation round the openings of the ducts of Bartholin's glands showing as round red spots; (5) scattered points of inflammation on the inner aspects of the labia minora and elsewhere; (6) erosion of the cervix and a purulent discharge therefrom; (7) granular vaginitis; and (8) the history of the occurrence of ophthalmia neonatorum in the preceding baby. From the presence of these clinical phenomena it is justifiable to diagnose gonorrhœal infection in pregnancy and to commence treatment. At the same time it is desirable to resort to the second means of diag-

nosis, the recognition of the gonococcus in smears of the discharge taken from the urethra, from Skene's ducts, or from Bartholin's glands. A negative result ought not to be taken as final, but several smears should be examined. At first the infection may have been a pure gonococcal one, but very often it becomes a mixed one in the chronic cases, and the colon bacillus, staphylococci, and streptococci may be found. In time a third means of diagnosis may be in common use, *viz.*, a complement fixation test (corresponding to the Wassermann in syphilis); but results have not so far proved so satisfactory as to warrant the placing of reliance upon this method.

The treatment of gonorrhœa as a complication of pregnancy, labor, and the puerperium has not proved so brilliantly successful as that of syphilis by novarsenobillon and mercury. One is constantly in difficulty between the desire thoroughly to remove the causal germs from the vagina and neighboring parts and the risk (by the very activity of the means used) of sending the microbes higher up and infecting deeper structures, *e.g.*, the uterine mucosa and the Fallopian tubes. For this reason douching has been comparatively little used in the Department in recent months. The treatment of the vaginitis is now regarded as the least important part: dry swabbing with protargol is commonly used along with powdering with some antiseptic preparation such as dermatol (bismuth subgallate). Other means in the local treatment have been found to be of considerable value. Of course absolute cleanliness is essential. Further, pus anywhere should be squeezed out by pressure and removed. For diseased follicles injection with silver nitrate or electrargol should be practiced with a blunt hypodermic needle. The urethritis is best treated with irrigation by means of potassium permanganate in solution (from 1 in 5000 to 1 in 8000). At the same time diuretics may be employed. In place of the irrigation urethral bougies containing ½ to 2 per cent. protargol may be used. For abscess of the Bartholinian gland one may either incise and pack or aspirate the pus and inject electrargol. If there is infection of the infant's eyes treatment must of course be extended to them. The local measures must be reinforced by general treatment. When there is profuse vaginal discharge and acute symptoms, it is advisable to insist on rest in bed for several days; such cases therefore are brought into the V. D. Wards. Fre-

quent sitz baths are useful. The use of vaccines is still largely in the experimental stage. The main object is to get a good immunizing strain of the gonococcus. The dose is an important matter. Some give minute quantities to start with as desensitizing doses and follow these with a massive dose. It is to be remembered that with detoxicated vaccines larger doses may be safely given. In the Department the treatment with vaccines has given rather poor results, possibly because so many of the cases seen there have been mixed infections. Autogenous vaccines, when they have been procurable, have done well.

The presence of gonorrhœa in a pregnant woman is an important factor in reaching a decision as to the obstetrical management of the case. This means more than the paying of special attention to the eyes of the infant at birth, although, of course, that is always of high importance if ophthalmia neonatorum is to be prevented. It may be noted in passing that in only one of the babies whose mothers received treatment for gonorrhœa in the wards did ophthalmia develop; and it is not without significance that this solitary instance was in the month when the Department is rather understaffed for holiday purposes. Gonorrhœa, however, has a more far-reaching effect upon what may be termed obstetric tactics than is usually imagined. In pelvic contraction, for instance, one is faced with a difficult problem. If the contraction be such as to present the alternatives of Caesarean section or induction of premature labor one's decision is hampered by the risk of allowing the escape of gonococci into the peritoneum and the infection of the uterine wound in the one case and by the danger of carrying gonococci up into the uterus on the bougies used to induce labor in the other. The result has been to lead us in the Department to experiment with other plans of inducing labor without employing bougies. In something like fifteen cases labor has been brought on by medicines given by the mouth and hypodermically, and the results have been most satisfactory; in one instance, however, the drug used provoked a tetanic state of the uterus causing some anxiety and requiring the continuous administration of chloroform. The procedure should not be had resort to in private practice, but is suitable enough in a hospital where the patient is under constant supervision. It must not be forgotten that all venereal patients are much more liable to become septic in connection

with labor and that therefore the strictest aseptic and antiseptic precautions must always be taken.

As judged by the sensitive index of the stillbirths the results obtained in the V. D. Department in 1921 have been highly encouraging. The cases naturally divide themselves into two groups, according as there was or was not previous supervision in pregnancy and anti-venereal treatment. Amongst the patients suffering from one or other or both of the venereal diseases who were sent in with no previous treatment as regards the maladies and no antenatal supervision as regards the obstetric characters of the case, the stillbirth rate was appalling: There were 33 such uncared for cases out of a total of 171 with 20 stillbirths or a rate of 606 per 1000; among the remaining 138 cases which received antenatal supervision and anti-venereal treatment there were only 7 stillbirths or a rate of 50.7. The figures speak eloquently in favor of antenatal supervision and treatment; and in other respects such as maternal morbidity and mortality they are likewise impressive.

[The Clinic was concluded with a visit to the four wards for the care of venereally affected cases in pregnancy, labor, and the puerperium, as well as to the labor ward for their delivery and to the laboratory for the pathological and bacteriological work connected therewith.]

In one ward (No. 16) there were four patients. One was the woman referred to as a contrast case in the lecture. She had syphilis with a marked positive Wassermann reaction and had come in during labor having had no previous treatment; she had been delivered of a macerated fœtus and a typical large syphilitic placenta. The second patient came in for an incomplete abortion at the sixth month with retention of the placenta; the afterbirth was adherent and had to be removed manually; the uterus was douched out and the interior was swabbed with pure carbolic and packed with iodoform gauze; twelve hours later she developed a temperature of 104°F., but under douching the temperature fell; and she made a good recovery. She also had a positive Wassermann. The third patient was suffering from gonorrhœal vaginitis and a marked discharge; she was some three weeks before full term, and was receiving the usual treatment. The fourth was also a gonorrhœal case who had been delivered with

forceps, and was convalescent; her infant was well. She had had previous care and treatment.

In another ward (No. 17) there was a patient who had been sent in with the symptoms of abortion. It was found to be inevitable, and the contents of the uterus were entirely removed. She was making a good recovery. She also had had no previous treatment and no antenatal supervision. She had marked syphilis, and had in previous pregnancies had three stillborn children. The three other women in this ward were all suffering from gonorrhœal discharges and were at various ages in pregnancy; they were all receiving the appropriate treatment.

In a third ward (No. 18) also were four beds. In one of these was a woman, a probable syphilitic, entering the ninth month of pregnancy; her abdomen was enormously distended and the cause was hydramnios; during the past few days she had begun to suffer from dyspnœa and the feet and legs were swelling. On the preceding day relief had been given by drawing off some of the liquor amnii by tapping the membranes above the os. [Note: A further tapping had to be done; then labor set in; and she was delivered of a normal, living child.] Another patient in this ward came in with labor in progress; it was a breech presentation and there was also a presentation of the cord; the child was delivered rapidly by manual traction. It was found to be asphyxiated and had a depressed fracture of the left parietal bone. The house surgeon by means of one blade of a volsella was able to elevate the piece of bone, and the child (now a few days old) has done well. The mother is the subject of gonorrhœa. Two other patients were pregnancies waiting for delivery; both had vaginal discharges for which they were receiving treatment.

In a fourth small ward (No. 19) was a baby who presented a somewhat notable example of life-saving under apparently hopeless circumstances. She was prematurely born at the seventh month and was the child of a woman with gonorrhœa who had received no treatment and no supervision. The birth, unattended, took place outside the hospital. The infant weighed only three pounds at birth, and in a few days developed a serious attack of ophthalmia neonatorum. She was brought into the Department almost as a forlorn hope; at first all efforts were concentrated upon getting her to live; this having been

accomplished the serious condition of the eyes was dealt with; she has now been in the Department for over seven weeks, and seems likely to do well. The Eye Department of the Royal Infirmary reported that there was no damage to the cornea and that the eyesight would not be permanently affected.

These patients exhibit very clearly two things: The extraordinarily good results obtained by the treatment of venereally affected pregnant women during the months of expectancy and by their obstetric supervision; and the disastrous results both to mother and infant of the absence of such treatment and supervision. The lesson is obvious.

GUARDING THE EYESIGHT OF SCHOOL CHILDREN

WITH A REPORT OF THE WORK ACCOMPLISHED IN THE EYE CLINIC FOR THE PUBLIC SCHOOL CHILDREN OF PHILADELPHIA IN 1921, WITH SPECIAL REFERENCE TO THE CONSERVATION OF VISION CLASSES

By M. E. SMUKLER, M.D.

Assistant Opthalmologist to the Bureau of Health; Opthalmologist of the Northern Liberties Hospital; Assistant at Wills Eye Hospital, Philadelphia

THE effects of the modern strenuous life upon human eyesight are being brought constantly to our attention, as physicians, by the ophthalmologist in medical literature, and to that of the general public, by lay writers who have been able to grasp the importance of the situation both in a practical and semi-scientific way, and who contribute in an efficient manner to current magazines, as may be seen from an article that recently appeared in the *Outlook*.

"It was brought out (in the discussion) that there were more children in the schools, and that they were spending more years in school than previously, with more strain and injury to the eyes resulting from study. More people than ever before were engaged in closer tasks at office desks and machines. The nervous, fast-moving character of modern life seemed to affect the eyesight. Food was probably deficient in the vital elements needed by the nerves and tissues of the eye. The abrupt changes of illumination due to the general use and misuse of electric lights were cited. The tax of motion pictures on eyesight was argued. Some one explained that there was a rapidly growing understanding of visual defects and weaknesses, instead of the neglect of the eyes that was so general in the past. Another cited the steady increase of competent optical specialists, not only in the cities but in small towns."

Daily newspapers and commercial journals are pointing out the new economic factors that have prompted the enactment of the recent working laws, child labor laws and industrial insurances, in which the importance of good vision is duly emphasized, while many large corporations and manufacturing plants now demand physical fitness of all their employes, not only for efficiency sake, but also as a protection to the public against personal and property loss, which makes eyesight an important factor.

Unfortunately, however, these physical examinations are not conducted at stated periods so as to insure continued efficiency, often the first examination being the only one made. For this reason there

are those employed at the present time in responsible places who are afflicted with poor eyesight.[1] Some are aware of their failing vision, but the majority are in total ignorance of its existence, and if perchance these breadwinners lose their positions, they encounter all sorts of difficulty in finding suitable employment elsewere. Children arriving at the working age are required by law in some of the states to come up to certain physical standards or tests before receiving the necessary papers to obtain employment, and many are denied the papers because of poor vision.

The harmful effects of refractive errors on the mental development of a growing child have become universally recognized. Statistics prepared by competent investigators both at home and abroad show that the lack of efficiency and backwardness are due to defective vision in from 10 to 50 per cent. Dr. L. C. Wessels[2] has pointed out that the furnishing of free glasses to school children is not a charity *per se,* but is a duty and an economic necessity. Because of compulsory education, the State is responsible for the children while in school. If it furnishes the scholars with books and other things to assist them in getting an education, why should it not furnish them with glasses when necessary, so that the community will get the full benefit of the money appropriated to educate them, as defective vision prevents many children from making proper use of the educational facilities extended them.

School medical inspection has done much to improve the condition of children during school life by ascertaining ocular conditions and urging all cases of defective vision to be corrected. In the year 1895, before the institution of school medical inspection in Philadelphia, out of 33,000 children entering first grade, only 53 per cent. reached the fourth grade, and only 13 per cent. reached the eighth grade. In the year 1905, when school inspection started in this city, out of

[1] It has often been urged that Pennsylvania pass a law demanding that all applicants pass a visual acuity test before being granted a license to operate an automobile. Many automobile and trolley car collisions which are said to be caused by reckless driving, I am sure, are in reality often due to defective vision, evidenced by the frequency that poor vision is seen in motormen and chauffeurs, both in private and dispensary practice.

[2] "Defective Vision in School Children from an Economic Standpoint," read before the Fourth International Congress of School Hygiene, 1913.

34,000 children entering the first grade, 64 per cent. reached the fourth grade, and 22 per cent. the eight grade.

In Philadelphia it cost about $56 last year (1921) to teach each pupil, and for every child *left back* a year on account of defective vision there is a loss of $56 to the State and considerably more to the child, because frequently at the age of fourteen a poor child will be put to work, and his earning power being curtailed on account of his poor education, he can contribute but little toward his own or family support. Philadelphia has solved this problem by establishing a Division of Ophthalmology (Public School Eye Clinic) under the Bureau of Health, where poor children may be refracted and furnished with free glasses.[3]

In the line of experimental research that our department has followed on the effects of eye strain on the child's mentality, our records of over 20,000 cases show that 60 to 70 per cent. of the children sent to our clinic for corrections of refractive errors were classified as backward, mentally deficient, stupid or habitually left back, and furthermore our follow-up system has proved that after their errors have been corrected, 70 to 80 per cent. of these progress and take their place in the class with the normal average child. The reason the remaining 20 to 30 per cent. did not progress was because their retardation was due to other causes than defective vision.

Thus it becomes necessary to search for defective vision in children as early as possible in an effort to correct the condition at a time when it is most likely to respond to treatment, and no time is better for the purpose than the earliest school age. This work was gradually undertaken by the School Medical Inspection Department in various cities. It was found from common experience that it was impracticable to have a large number of children's eyes properly examined in the average hospital dispensary, because a correct refraction of a young child is a tedious and tiresome task, and for this reason in nearly all the eye dispensaries the refraction is passed on to the novice or the lowest assistant in the clinic, and frequently when the number of examinations is very great, the parent is told to continue the drops and bring the child back in a day or two, thus causing the parent to lose much time from their work or house duties, so that they frequently

[3] The cost of a pair of spectacles in 1921 was $1.70.

become discouraged or take the child to a store for its glasses. In either case the result is the same; the child gets no refraction or a poor one. Frequently the purchase of glasses prescribed at the hospital dispensary is prevented on account of poverty or through ignorance. We have often seen children come to our clinics wearing glasses from the five and ten cent store or those belonging to some other member of the family. Neither is there any kind of a practical follow-up system carried out in the average dispensary, so that special cases can be recalled and observed from time to time—as is done in our clinic—so the child continues to struggle along greatly handicapped, and falls behind in his classes on account of his defective vision.

In order to obviate these dispensary shortcomings and abuses there began to crystallize the importance of establishing public school clinics, which are now organized in most of our large cities, where highly efficient and competent ophthalmologists with special training are installed to look after children having defective vision, to give treatment when needed, and to carry on a practical follow-up system. Investigations by our follow-up system show that many of the so-called stupid, mentally deficient and backward children sent to the clinic were in reality bright and normal, but handicapped by defective vision, which when carefully refracted and the children given proper glasses, all evidences of their stupidity disappeared. This certainly is an economic problem, rather than a charity, as it reduces the cost of education and increases the efficiency of both the pupil and teacher at the same time.

When the clinics were first opened, opposition from the parents was common, because they did not want their child's appearance spoiled by the wearing of glasses; now we seldom hear of this complaint; in fact the parents are usually anxious to help us in our efforts, since they realize the value of good vision, and the handicap that poor vision may prove in securing a position, especially since the public has been educated to the fact that frequently many of these defects can be easily remedied in a child and not later in life.

The Eye Clinic in Philadelphia (Fig. 1) works in direct coördination and coöperation with the Division of School Medical Inspection. The system now in operation between the schools and the Eye Clinic

Fig 1

View of the Philadelphia eye clinic showing the school children being measured for glasses immediately after refraction; the glasses are delivered to them in forty-eight hours.

Fig. 2.

View of children brought to the clinic in groups; their eyes have been prepared for examination and refraction by the school nurses.

Fig. 3.

One of the special retinoscopic rooms in the Philadelphia eye clinic.

is to take care of all eye patients who cannot afford a private physician, with as little loss of school time as possible to the child. The school nurse gets the parent to sign a consent card for the child found to have defective vision by the school medical inspector. The nurse brings these children to the clinic in groups (Fig. 2), properly prepared for the examination of the eyes (Fig. 3).

There were 10,724 visits made by school children to the clinic during the year 1921, summarized as follows:

New cases	3,510
Refractions	3,254
Prescriptions for glasses verified	1,946
Visits for diagnosis, treatment, revisits, etc.	2,014
Total	10,724

One thousand nine hundred and ninety-two pairs of spectacles (complete) and 163 lenses were furnished free to children whose parents were unable to pay for them.

Eighty-five per cent. or 2989 children were from public schools.

Fifteen per cent. or 521 children were from parochial schools.

The diagnoses of 3254 refractions done in 1921:

Hyperopia	1171
Hyperopic astigmatism	107
Compound hyperopic astigmatism	1095
Total hyperopic cases	2373
Myopia	206
Myopic astigmatism	53
Compound myopic astigmatism	257
Total myopic cases	516
Mixed astigmatism	240
Antemetropia	45
Anisometropia	20
Total refractive errors	3194
Refracted and found normal	60
Total refractions	3254

The following pathological conditions were found in children sent for diagnosis or during refractions:

Acute conjunctivitis, 15; Follicular conjunctivitis, 1; Vernal catarrh, 1; Trachoma, 1; Hordeolum, 10; Blepharitis, 16; Blephrospasm, 1; Stenosis of tear duct, 3; Entropion, 1; Strabismus, 209; Nystagmus, 19; Paralysis of external rectus,

1; Corneal opacities, 202; Corneal ulcer, 3; Anterior synechia, 5; Posterior synechia, 3; Iritis, 1; Interstitial keratitis, 4; Congenital cataracts, 6; Dislocated lenses, 3; Neuro-retinitis, 2; Macular choroiditis, 8; Optic atrophy, 5; Persistent pupillary membrane, 2; and Persistent hyaloid artery, 2.

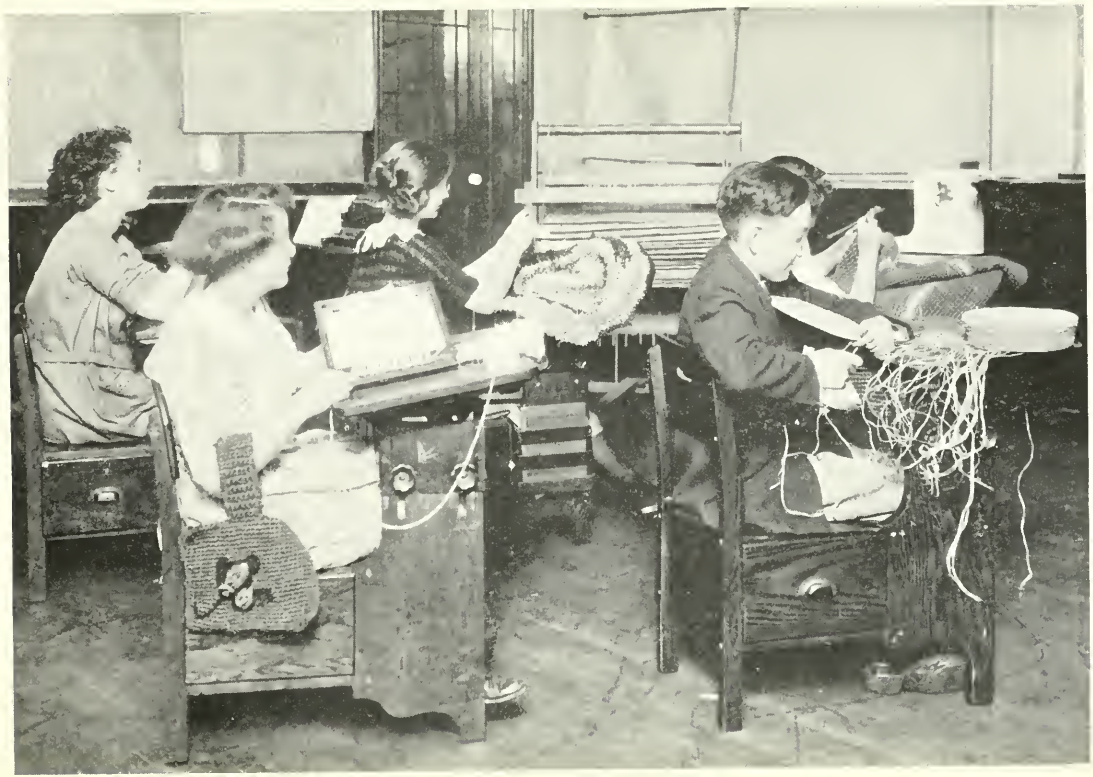
The following are the diagnoses of 36,288 refractions done in the clinic under a mydriatic since 1908, showing the proportion of different refractive errors.

Hyperopia	12,332		
Hyperopic astigmatism	643		
Compound hyperopic astigmatism	14,057		
Total hyperopic cases	27,032	27,032	75 per cent.
Myopia	1754		
Myopic astigmatism	227		
Compound myopic astigmatism	2373		
Total myopic cases	4354	4,354	12 per cent.
Mixed astigmatism		2908	8 per cent.
Antemetropia and anisometropia		1645	5 per cent.
Aphakia		9	
Total refractive errors		35,948	100 per cent.
Normal		340	
Total refractions		36,288	

It was annually found that there were cases of defective vision which glasses would only partially correct, thus making these children unfit to attend the regular classes. I refer to the progressive myopes, high astigmatics and other pathological conditions which may cause poor vision. Some of these children—progressive myopes—were really better off out of school than to educate them at the expense of their eyesight. Heretofore some of the worst cases were kept out of school and not being able to work on account of certain provisions in the Child Labor Laws, there was nothing for them to do but loaf the streets until they were sixteen years of age, when they were allowed to work, but greatly handicapped in earning a proper livelihood on account of their poor vision and lack of education.

Finally, after a number of years of agitation by our department, conservation of vision classes were establised in Philadelphia, Pennsylvania, in 1920 for these children with a viewpoint of making full use of every sort of handcraft (Figs. 4 and 5) that will develop

Fig. 4.



Classroom of children, with defective vision, being taught a handcraft.

Fig. 5.

Another conservation of vision classroom, showing the children at work.

Fig. 6.

Map of Philadelphia showing where the homes of children with defective vision are located, who were recommended by us to the conservation of vision classes in 1921. Location of schools having these classes in them is also noted.

Small black dots show approximate location where the child with defective vision lives.

Large black dot shows location of schools having detective vision classes in them.

Ringed black dot shows location of the homes and the great distances travelled by these children when the conservation of vision classes were located in 1920 in but one school.

FIG. 7.

View of special desks and other equipment used in one of the conservation of vision classes in Philadelphia.

attention, method and skill, with a minimum use of the eyes, so that eventually they can learn a trade for a livelihood where there is a minimum amount of tax on the visual apparatus.

All candidates for these classes are examined by our oculist who makes the final recommendations as to the assignment of a child to a normal or sight saving class or, when necessary, to a blind institution. The children in the conservation of vision classes are cared for by a coöperative plan between the special teachers of these classes, school nurses and the oculist in our clinic. By this coöperation the child is kept constantly under observation and treatment, which overcomes the great obstacles in securing results in the handling of this class of cases in hospital dispensaries with no official connection with the Department of Education.

All those not under private treatment, which is the case in a majority of these children, active treatment is given for the existing condition as indicated. Once a year the pupils in these classes are refracted, and the vision noted for observation purposes. The value of coöperation in this work is shown by the large number of children who are sent to us as candidates for the conservation of vision classes, and who, on being refracted and treated, are given good vision and returned to a normal class. All children having less than 20/70 vision with their proper refraction in the best eye are referred to the conservation of vision classes. The progressive myopes are an exception to this rule, when we find that the myopia has markedly progressed for two consecutive years, even though the vision is better than 20/70, we refer them to the sight saving classes. Those having vision less than 20/200 in the best eye with the best possible refraction are referred to blind institutions. The following cases were recommended by us to the conservation of vision classes, summarized as follows:

Myopes	93
Corneal opacities	60
Nystagmus	8
Choroiditis	8
High hyperopes and high astigmatism	8
Optic atrophy	3
Cataracts	2
Total cases	182

FIG. 8.

slight noise back of him.

On the window-sill, facing the boy, stood a small looking-glass; and almost the entire cottage could be seen in this. As

Specimen of type used in clear type reading book, which is used by the pupils in the conservation-of-vision classes. Writing is done on the same scale as that of the type. (Edited by Miss Frances E. Jenkins and Miss Anna E. Logan, of Cincinnati. Published by the Howe Publishing Society for the Blind, Cleveland, Ohio.)

The first classes were held in the Lincoln School in 1920, where in 1921 there were three classes with 44 pupils. In 1921 five additional classes with 37 pupils were formed, the object being to distribute these classes where the need is greatest (Fig. 6), provided the proper facilities can be made for them. Our desire is eventually to have a class in every ward of the city, because it is dangerous for these children with their defective vision to travel a great distance, especially through congested districts where the traffic is large.[4]

The curriculum for the sight saving classes is arranged by the Department of Education, so that these children are developed physically as well as mentally. They average about 10 pupils to a class. The schoolrooms are equipped with proper desks (Fig. 7), extra large printed books (Fig. 8), special typewriters having large type, and most favorable natural and artificial illumination, and the children receive individual assistance from a special teacher so as to permit them to perform as nearly regular grade work as is possible without any injury to their already defective eyes. No homework is given. Many of these pupils are of high intelligence, and this good general training, with special attention to the development of thought, initiative and good speech, fits them for positions of usefulness and responsibility, such as storekeepers, collectors, agents, visitors, weavers, piano-tuners, etc. Occupations such as these present no risk to the eyesight, and those engaged in them eventually become useful citizens to the State.

[4] This Fall, 1922, four more classes have been established.

WHAT A SOCIAL WORKER SHOULD KNOW ABOUT MEDICINE *

By JOHN A. FOOTE, M.D.

Physician to the Children's Hospital, Washington, D.C.

Not so very long ago I was speaking to a friend concerning the desirability of training as Social Workers more young women who are in the field of religious charitable work, when he asked me point blank, "What is a social worker?" It is really not quite so easy to define this term in a few words, and I had quite lost the thread of my original argument before I had finished with my definition.

The term sociology is in itself not easy to define, unless we follow the lead of that teacher in a middle-western university who, when asked for an explanation of the meaning of this word, said: "If it's interesting it is sociology."

The very diffuseness of this newest of new sciences makes it difficult of limitation and concise definition. Indeed there are some who insist that sociology is not yet a science because science consists in the making of numerous accurate observations and drawing from these grouped observations equally accurate conclusions. Sociology is still in the swaddling clothes period of the collection of facts. In addition it is a study in which humanitarianism and science are intermingled and combined.

The chemist who tabulates his data in the quiet of the laboratory can easily have a more detached viewpoint than the social worker who marshals her human facts in a noisesome tenement where even two and two do not seem to make four.

DIAGNOSING SOCIAL MALADJUSTMENT

It would be permissible to define a social worker as a diagnostician of social maladjustment and social pathology. The social worker in her field would under this definition bear the same relation to the individual and the family that the physician does to his patient. The necessary limitations and the scope of the social worker's influence

* Read before the National Conference of Catholic Charities on September 18, 1922, at Washington, D.C.

may perhaps be well illustrated by carrying this analogy further. For example, the physician when training for his profession is taught that the body is built up of innumerable small cells of various kinds and various functions. These cells are bound together so that aggregated groups of cells constitute organs such as the heart, liver, kidney, brain, skin, etc. These organs in turn are grouped together into systems, such as the circulatory system, made up of the heart, and blood-vessels, and the nervous system, made up of the brain, spinal cord, nerves, etc.

But while the physician studies the minute structure of the cells of the body it is not necessary for him in diagnosing disease to remotely consider or examine these tiny cells—rather to do so would probably cause him to overlook the functional manifestations of disease shown in the organs and in the groups of organs affected. And so the social worker, in making her diagnosis of the causes of the social disability of an individual or a family, must consider only the outstanding factors which might prevail to produce the existing condition, and not every minute detail of family history.

IGNORANCE AND DISEASE

The influence of disease in either producing or resulting from poverty and ignorance is almost self-evident. It would be worse than useless to argue that the social worker need not know anything about disease and its causes. The question of disease enters into nearly every social history of the family or the individual and it cannot be ignored. But it is no more necessary that the social worker should be instructed in the diagnosis and treatment of the thousand or so diseases that afflict humanity in order to be able to obtain an intelligent social history, and conduct an intelligent social investigation, than it is necessary for the physician to know the exact condition of every cell in the human body of his patient in order to make a correct diagnosis. Long before the physician could finish such an exhaustive investigation his patient would either have recovered or died.

What then should be the scope of the social worker's knowledge in the field of medicine? The influence of housing, food, sanitation, occupation, narcotic addiction, and subnormal mentality in the production of disease are all phases of medicine in which the social worker may with profit interest herself.

THE SOCIAL SPECIALIST

Specialism is found in the field of social work perhaps even more markedly than in the profession of medicine. Thus we have the social worker doing general settlement work, the hospital social worker, the social worker in industrial communities, the social investigator of city and rural charitable organizations, and perhaps many other variations in which the worker may come in contact with a special type of individual or in a special type of community. Each of these various special fields will probably require a different type of public-health knowledge.

Paradoxical as it may seem, the hospital social worker probably requires less of special medical knowledge than any other class, since the physician and his assistant, the visiting nurse, are very close at hand. It is also obvious that the social worker in rural communities will have, perhaps, relatively little use for her knowledge of diseases peculiar to conditions of tenement housing and overcrowding, which are so frequently encountered in the city. But whatever may be the peculiar training required of the specialist, it would seem that a knowledge of elementary physiology and hygiene, especially personal hygiene, as well as some knowledge of the pernicious effects on society of inadequate sanitation, of the commoner communicable diseases, of alcohol and narcotic addiction, of mental defectiveness, and last but not least, of ignorance of the laws of health—that some knowledge of these subjects should be acquired by the student preparing for social work. Thus she will be able to attribute to these and similar causes their proper place in formulating a social diagnosis of her cases, overlooking no fact which may furnish a clue toward remedial treatment. She should know enough to realize the need for expert medical assistance where disease is suspected as being the cause, or one of the causes, of social maladjustment, and she should have enough of this sort of knowledge to realize the danger of superficial judgment.

To the specialist in social science will open many tempting vistas for investigation of the relation between living conditions, morbidity, and mortality, but such investigations should always be undertaken under the direction and guidance of a physician who has had proper training in public health work and vital statistics. The term medico-social has been invented to designate such investigations, because such

work really belongs to a newer kind of medical science in which the public health physician treats the community just as the private physician treats the individual.

DISEASE AS A CAUSE OF SOCIAL INEFFICIENCY

It is well understood then that the social worker must consider disease as an important cause of social inefficiency, and must know enough of the general facts of disease to be able to so consider it. She will require even less knowledge of medicine than the trained nurse, and like the trained nurse will not be competent to diagnose disease, since she will not be trained to do so. Even the specially trained public health nurse is not competent to make a medical or surgical diagnosis, in spite of a somewhat recently growing popular opinion to the effect that a nurse's training affords her a certain amount of equipment for such diagnosis and treatment.

MEDICAL BOUNDARIES OF SOCIAL KNOWLEDGE

It will be recognized then, that the social worker will be within safe intellectual bounds if she limits her studies to such conditions and social maladjustments as are brought about or favored by improper environment, poverty, unhygienic industrial occupation, mental infirmity or ignorance, all of which are potential predisposing factors in the production of disease and of diseased conditions. A social worker cannot well ignore in her investigation any condition possible of remedial treatment. Her education should include all knowledge which is necessary to fit her for her work. It will be found not only useful but perhaps necessary to include in her course of training such medico-social study as will enable her when she practices her profession to keep in mind the importance and frequency of disease as a predisposing or causative agent in the pathology of human society.

CRIME AND INSANITY

By PAUL E. BOWERS, M.S., M.D.

Neuropsychiatrist, United States Public Health Service Hospital No. 24, Palo Alto, California

THERE is probably no type of crime that has not been committed by insane persons, and often the intrinsic acts of crime are not to be distinguished from crimes committed by normal persons, except by the underlying motives which prompted their commission. The overt act committed by the mentally alienated usually carries with it tangible evidence of mental disease. The attending circumstances in such instances likewise are marked by the distinguishing characteristics of mental unsoundness.

The dangerous assaults committed by the insane epileptic in the furore and frenzy of an epileptic automatism, the violent acts perpetrated in the agitation and delirium caused by alcoholism or by narcotic drugs, are so labelled as to leave but little room for doubt as to the mental status of the persons performing them.

Impulsiveness is a symptom of insanity which is often shown by crime. The insane often react in a very sudden and precipitous manner to overpowering obsessions and imperative ideas. The very lack of forethought, the suddenness and violence of certain criminal acts, point to the nature of their origin. Very often the misdemeanors are so absolutely silly, ludicrous and devoid of any purpose whatsoever, that they could have been committed only by an individual suffering from some form of dementia. We are at once suspicious of the mental integrity of the person who commits crime openly and boasts of it as an accomplishment.

The crimes of some types of insanity are so characteristic that the act at once suggests the form of insanity with which its perpetrator is suffering; yet, on the other hand, the mentally unbalanced may use such deliberateness, such skill in execution, such a degree of apparent reasonableness, that all except qualified alienists are ready to condemn them as willful and perfectly sane criminals. An insane criminal may be so cunning as to hide his crime and seek to evade

responsibility and the consequent punishment. But his self-preservative act should not be employed as an argument or criterion to prove the sanity and responsibility of a criminal.

Again, the pathology of a criminal act may be so hidden and obscure as to defy the ordinary means of detection. In other words, the physical act of the crime may be but a bubbling expression of its hidden pathological source, which lies deep in the substrata of a diseased intelligence. Instances of this sort are often the subject of medico-legal contention.

The author established at the Indiana Hospital for Insane Criminals, in 1911, a psychopathic laboratory for research in clinical criminology. Five thousand prisoners were examined physically, neurologically and psychologically in this laboratory with the special object in view to discover the types of crime that usually attend the different psychoses. Much has been written in a general way about the relationship of insanity to crime, but heretofore little has been published concerning the definite connection of disordered states of mind with the commission of criminal acts. Each psychosis in its relation to criminal behavior will be dealt with separately in this article.

EPILEPSY (Fig. 1)

History is replete with examples of the causal relationship that this disease has sustained to delinquency. The remotest ages of antiquity furnish us with very striking examples. Mythology tells us that Hercules murdered his wife, Ophelia, and their children, during one of those unconscious automatic states that are characteristic of epilepsy. Seneca tells us: "One day, as Hercules was offering a sacrifice to Jupiter, he suddenly stopped, rolling his bloodshot eyes in a hideous manner, the saliva ran down his beard, his smile was convulsive and strained, and laying aside his garments, he became very much agitated. They thought he had returned to his senses, when he suddenly rushed to his weapons, ran after his father, his own children, and everybody, till finally he slew his wife and children. He was about slaying his father when Pallas appeared and checked him, throwing him on the ground. Then he quickly fell into a profound sleep. As he awoke the sight of all the slain around him

terrified him and his despair became extreme when the news was broken to him that he alone was the author of all this slaughter."

Epilepsy is probably responsible for more pathological offenses than any other form of positive mental disease. It is very common for prison physicians to observe that many prisoners have distinct dizzy spells, and these are many times true forms of *petit mal* which may be overlooked by a careless mental examination.

Marked changes in the morals and the emotions are most constant characteristics. The epileptics, as a rule, are most mercurial and volatile in their temperaments. The merest trifles are sufficient to stir them to serious outbreaks of temper and violence. They are radicals of the most extreme type, and especially is this true in the sphere of religion and politics. Their manner of living and their modes of behavior are practically regulated by their appetites. They love power and notoriety, and they shrewdly use immoral and illegal methods to secure these. They are extreme sensualists and are prone to commit sexual crimes, as rape, incest and sodomy. Delusions of persecution are common characteristics of the epileptic mental degeneration and therefore it is very easy to see why dangerous assaults should be so common among epileptics with their hair-trigger temperaments, their lack of emotional control and their impetuosity.

Clouston has well said that "Murder by an epileptic should be looked upon as being as much a symptom of his disease as is larceny by the general paretic." Delasiauve forcibly states: "It is certain that on passing an epileptic we elbow one who might be an assassin, and that epilepsy, through the delusional ideas it originates, furnishes a considerable share of the crimes ascribed to mental alienation."

The phenomenon of epileptic automatism has long been observed, but a concise explanation of this phase of the disease has not yet been offered. We know, however, that some epileptics complete certain definite acts in a seemingly perfectly conscious and coherent manner, but in reality consciousness is practically blotted out, and when the individual regains his mental status there is likely to be no memory of any of the acts that he may have committed during such periods, or if he does have any memory, it is usually but an indistinct hypnogogic idea that closely corresponds to the dream state.

The automatic acts of the post-epileptic stage more frequently

Fig. 1.

Epileptic dementia. Crime: Habitual thief.

Fig. 2.

Paranoia. Crime: Murder. Patient thought that he was St. Paul reincarnated.

Fig. 3.

Paranoid dementia præcox. Crime: Murder.

Fig. 4.

Paranoid dementia præcox. Crime: Murder.

Fig. 5.

Dementia præcox (paranoid type). Crime: Assault and battery with intent to murder. The patient with this home-made suit of armor went into the courtroom and shot the judge and fired at the prosecuting attorney. He thought these officials were instruments of a powertul oil corporation and that those connected with the company were persecuting him. He covered his armor with an overcoat and a slouch hat until he got inside of the courthouse.

follow the *petit mal* paroxysm, and it is rare for criminal acts to be committed following a severe form of the major paroxysm. It is usually the rule that the actions which are performed in a post-epileptic automatic state are always the same in character. The act performed usually portrays in some manner an habitual movement that is customary to be made in normal consciousness. In the consideration of epileptic criminal acts we must bear these facts in mind. If called upon to give expert testimony as to the responsibility for criminal acts that may have been performed by an epileptic in the post- or pre-epileptic automatic state, we must determine whether the overt act was habitual in any character or whether the person was accustomed to performing similar actions when " at himself."

It would be in perfect harmony with the observations that have been made to find an epileptic butcher who had assaulted another individual with a knife, nor would it be strange to find a soldier in a post-epileptic state shooting someone. But should a butcher kill an individual by administration of poison, we should be exceedingly slow to regard such a crime as an expression of epilepsy, since the handling of drugs is a procedure foreign to the act of cutting meat.

The condition known as psychical epilepsy is one in which the paroxysm is replaced by a nervous storm which is not accompanied by the usual signs of epilepsy. Psychic epileptics may commit thefts, arson, rape, assaults and homicides, and from a medico-legal aspect in fixing responsibility the existence of the automatic state at the given moment must be the determining factor.

PARANOIA AND PARANOID STATES (Figs. 2, 3 and 4)

Paranoia and allied paranoid states furnish us with a very large quota of pathological crimes. The most common of these are homicide, homicidal attempts, assault and battery, blackmail, perjury, impersonation of officers and sexual crimes. The most dangerous of all insane patients is the one who harbors in the recesses of his diseased mentality systematized delusions of persecution. This is especially true of the paranoiac, who many times appears to be intellectually normal and occasionally, aside from his paranoidal tendencies, may be the superior of the average individual. The proper perspectives of life are impossible for the paranoiac since each

instance and circumstance is colored and tinged by an abnormal sensibility and reaction to the most commonplace and trivial affairs.

The paranoiac in the stage of persecution, out of the most insignificant circumstance, constructs a nebula of persecutory ideas which are intangible and obscure. Finally these hazy, indistinct ideas of persecution take on a more definite character, and then step by step, supportive and contributive ideas are formed and elaborated which build up a definite, systematized, delusional preconception or system of thought through which must pass every idea that is translated into action.

This delusional formation is so closely and intimately connected with the whole consciousness, that it regulates and dominates the individual's manner of feeling, thinking and acting. It is easy to see, therefore, that any paranoiac is a potential homicide while harboring delutions of persecution. Should he believe that his supposed enemies have designs upon his life, or that they desire to make him the butt of their ridicule, or the object of some diabolical conspiracy, it is not at all strange that the persecuted should turn persecutor.

He employs logical methods of argument to convince himself that he is perfectly right in seeking means to protect himself against machinations, and should he ever be called into court to explain some of his erratic behavior, he is more than convinced that he is justified in using any measure that he may see fit to employ.

DEMENTIA PRÆCOX (Figs. 5, 6 and 7)

The crimes of those suffering from dementia præcox partake of the fundamental basic characteristics of mental enfeeblement that mark this psychosis. The misdemeanors and unlawful offenses of those affected with this disease are characterized by more or less defect of reason and judgment, a marked emotional poverty, a more or less complete state of indifference, a condition of puerility and often a thoughtless, senseless and impulsive brutality. A very large number of violations of the law committed by insane persons are directly chargeable to dementia præcox, while the ranks of criminals, prostitutes and hoboes are constantly swelled by additions of those so affected. Wilmans found more than half of a large number of vagabonds examined to be cases of dementia præcox.

Persons with arrested dementia præcox are frequently noted in prison. In these types of this disease, the progress of the underlying dementia is inhibited, and though the psychosis fails to reach a stage of dementia, the individual never again reaches his own normal mental status.

A distinct difference corresponding to the three main divisions of dementia præcox is shown in the character and the circumstances attending the crimes committed by the patients with this disorder. The crimes and misdemeanors of hebephrenia partake of the character of this form of dementia præcox—the crimes are petit larceny, trespass, vagabondage, drunkenness, the breaking of box-cars, sexual offenses, and public prostitution in the female. The offenses which often go to make a part of the catatonic symptom-complex occur with much less frequency than in the paranoid and hebephrenic form. The crimes and misdemeanors of this type are marked by impulsiveness, thoughtlessness, and a lack of premeditation, and usually no effort is made by the patient to escape the consequences entailed by his criminal actions. The catatonic makes vicious assaults, commits murder, and destroys property by incendiarism. The paranoid form furnishes a large number of criminals. The delusions of persecution lead to assault, homicides, theft of property, blackmail and perjury. The crimes of hebephrenia and paranoid dementia præcox are about equal in number.

GENERAL PARESIS

The crimes of general paresis as compared with epilepsy, dementia præcox and paranoid states are comparatively rare. Of two hundred and five admissions to the Indiana Hospital for the Insane Criminals but five patients were general paretics.

The criminal offenses of general paresis usually fall into one of the following categories: Immorality, alcoholic debauch, indecent behavior, thievery, dishonest speculation, forgery, and very rarely homicide and suicide. The misdemeanors of paresis generally occur in the incipient stages of this disease. The moral qualities of the mind share in a very large way in the general degeneration. Very often the moral symptoms are the first to point to paresis. The paretic fails to understand and seems entirely oblivious to the moral relations that he sustains to society and his family. His speech, which was formerly

chaste and decent, becomes filled with profanity and obscenity. The once temperate individual indulges in wild alcoholic debauches, and the formerly respectable husband and father seeks the company of the public prostitute openly and without shame.

The paretic manner of committing misdemeanors, and the environment and circumstances attending them, generally leave room for little doubt as to the source and nature of their real origin. The patient has no apparent knowledge of the quality and nature of his overt acts. The paretic seldom tries to hide his crime and he displays no foresight or caution. If on a tour in a department store, the rich and well-to-do patient may steal articles of small value, such as handkerchiefs and gloves. He will pocket them under the eyes of the clerk, in a state of apparent forgetfulness, after having examined them as a prospective buyer.

Magnan recites the case of a paretic who asked the aid of a policeman to help him steal a barrel of wine. The perfect frankness, innocence and apparent reasonableness of the request made of the policeman so impressed him that he assisted the paretic to carry out his theft.

Under the dominating influence of grandiose delusions, the victim of paresis forges checks, makes fraudulent claims on property, gives false promissory notes, makes wild speculations in the market and undertakes impossible financial operations, without apparent knowledge of the quality of his acts.

MANIC-DEPRESSIVE INSANITY

Crimes of the manic-depressive psychoses are relatively rare. The alternate cycles of good behavior and freedom, crime and imprisonment which the author has noticed in habitual criminals somewhat resemble the manic-depressive psychosis with its intervals of lucidity, separated by periods of depression and excitement. In the period of remission of the cylic form of criminality the prisoner is exceedingly well behaved and often takes a very active part in the religious services and societies at the prison, and often it is thought the individual has reformed and will become a model citizen. He is sooner or later discharged from the prison and he does exceedingly well for a limited time. But shortly our hopes are dashed to the ground, for

a second cycle of criminality develops, new crimes are committed, and the individual is returned to the prison from which he was but recently discharged or is sent to some institution in another State.

Depressive Phase.—The most common violent act of this phase is suicide. All melancholic patients are potential suicides, and in a state of raptus this act is frequently performed in public and without premeditation. The depressive patient sometimes becomes so occupied with a single idea that it amounts to an obsession. These ideas are often very terrifying and brutal, and because they occupy the entire field of consciousness there often develops a state of "raptus melancholicus" in which their absorbing obsessions are translated into murder, vicious assaults, mutilations of the body, especially of the genitals, and the most painful forms of suicide.

Consciousness is markedly clouded in these outbreaks of delirious passion, and the memory, if retained at all, is imperfect and hazy concerning any action performed during this period. In the state of raptus, guided by a delusional sympathy, a mother will murder her children to protect them from hardship, trials and supposed evils with which she thinks they are threatened. An individual once made an attack on an English king knowing that such a crime would result in his death. He was impressed with ideas of his own sinfulness and unworthiness and thought that his own death was necessary for the good of humanity, but because he was so scrupulous about the sin of suicide he assaulted the king, knowing that the punishment for this act was death.

Manic Phase.—The crimes of the manic phase are also rare. The extreme psychomotor activity interferes with the accomplishment of definite criminal acts. The patient is destructive rather than criminal. He is given to the demolition of furniture, mirrors and window panes. They not infrequently disturb public peace by running amuck through public thoroughfares. The ordinary womanly modesty is frequently lost in the manic phase. Female patients of this type are often arrested and charged with public indecency and exposure. Nymphomania, kleptomania and dipsomania are not uncommon symptoms. The maniacal excitement occasionally assumes a character of extreme fury and frenzy, during which vicious assaults and homicides are committed.

It is not at all to be wondered at that crimes, misdemeanors and the violations of morality should be found in the symptom-complex of hysterical insanity. The exaggerated impressionability to external stimuli, the abnormal tendency to simulation, the excessive emotionalism, the volitional impairment, render the patient a plaything of his whims and passion and the easy victim of evil circumstances. The combination of these named psychic attributes of this mental anomaly create or constitute a condition of moral incoördination.

Delusions of persecution are to be expected in the hysteric whose abnormal sensitivity to the slightest irritating trifles translates the most common relations of life into schemes and machinations for his injury. It naturally follows that homicidal assaults should grow out of this disordered, paranoid state of mind.

The basic eroticism of hysteria leads to sexual crimes. The hysterical ascetic in his life of imperfectly repressed sexual desires and celibacy often sinks to a state of homosexuality, which finds relief in such sexual crimes as sodomy and bestiality. Other hysterics, through fear of venereal disease, through dread or shame, or a horror of being detected in illicit sexual relations, frequently commit rape on infant children.

Individuals of this type are to be found in every prison, and we have known one or two instances where they figured prominently. A woman, well connected, but cut loose from her family and rather repudiated by her relatives, used to frequent doctors' offices and have hysterical attacks there, and in one or two cases, at least, attempted to get up compromising situations, and once succeeded so far as to give considerable mental uneasiness for a time to a rather prominent physician. There are cases on record where still more serious consequences have resulted; men have been convicted of crimes of which they were innocent, on false testimony of hysteric women.

" While this mental disorder is by far most frequent in the female sex, it is not unknown to males; of course, in these cases the symptoms are somewhat modified, but it occurs only in men with somewhat abnormal and feminine mental organizations. In some of these, sexual perversion is a notable symptom, and it seems probable that this hysteria is at the bottom of many cases of this abnormality.

"In male hysteric insanity we see many of the same tendencies to morbid emotionalism, eroticism, false accusations, the exaggerated suggestibility, certain kinds of delusive conceptions, occasional threats or apparent attempts at self-injury or suicide, refusal of food, etc., that we observe in the female, but actual hysteric convulsive attacks are very rare, and the well-marked hysteric physical stigmata are also uncommon. Male hysteric insane are more likely to be suicidal or homicidal than are the females."

Something may be said in regard to traumatic hysteria, which sometimes amounts to a kind of insanity, showing itself in an exaggerated valuation of physical disabilities and a certain moral weakening that leads the individual to overact and sometimes to simulate, and they are the *bête noir* of the prison surgeon. He is irritable, quarrelsome, goes about seeking to provoke an argument, and constantly complains that he is ill-treated by the prison officials, that unfair tasks are assigned to him, and that fellow prisoners steal his tools and delay his work. He constantly makes demands for interviews with the disciplinary officer. He is rebellious at discipline; finds obedience to the prison's simplest rules a hard task. At other times he is extremely cheerful, vivacious, and his actions are liable to overstep the bounds of prison convention. This brief period of apparent improvement in conduct is usually followed by a train of hypochondriacal complaints.

This type of prisoner comes to the sick line every morning. One day he complains of precordial distress, the following day he confidentially tells the prison physician that he has very frequent nocturnal emissions; that he is troubled with nightmare and insomnia. At the next morning's sick call he gives a new revelation concerning gastric disturbances with which he suffers. In a few days he becomes extremely depressed and melancholy. He imagines himself the victim of conspiracy by the officials of the institution. He becomes lachrymose and relates his grievances to his fellow prisoners to create sympathy. Failing to do this he frequently pretends to attempt suicide. Should this fail to arouse the sympathy which he morbidly craves, he may become maniacal, throw his food on the floor, break the dishes, tear his clothing and talk in an incoherent and senseless manner. After a few days, whether placed in the hospital or not, his

mental condition returns to its normal state, and in course of time another cycle of such conduct is enacted.

PUERPERAL INSANITY

Puerperal insanity is a generic term applied to certain psychotic symptoms which occasionally attend the physiological epochs of pregnancy, parturition and lactation in those who possess a hereditary predisposition. The causal factors operating to produce this psychosis are the lack of proper medical attention at the time of childbirth, the infection and exhaustion, shock and hemorrhage, the mental anxiety and fear attending this physiological cataclysm. It has been claimed that this mental disturbance takes place about twice as often in illegitimate pregnancies as in legitimate ones. This fact seems to indicate that the psychogenic factor of worry, remorse and shame exert a tremendous influence for the production of this disorder.

Occasionally violent states of mania and frenzy are noted in puerperal insanity and during these periods of great motor excitement, restlessness and delirium, criminal acts are committed, and chief among them are infanticide, suicide and homicide.

A large percentage of infanticides may be charged to the insanity attending the puerperium. It is a strange perversion of the maternal instinct for a mother to murder her helpless offspring, and in every case of puerperal insanity the infant should be taken from its mother. It seems as though this mental disorder is not confined to human beings alone. It is a well-known fact that horses, cows, rabbits, squirrels and cats often kill their young at birth or soon after. A hog may even kill and devour her entire litter.

SENILE PSYCHOSES

It is commonly observed that, as the period of senescence approaches, the fires of passion are cooled, the ambitions of youth are quieted, the scheming and planning of youthfulness for the future successes and work to be accomplished cease, and all is changed into a life of reminisences and metaphysical and religious speculation. We pay the proverbial reverence to gray hair, the stooped form, the slow, unsteady, tottering gait, and to the kindly, human sympathy so characteristic of the aged.

But this senile period of mental and physical decay is not always attended by a peaceful and undisturbed serenity. Occasionally there is a profound moral deterioration. An even, quiet spirit gives way to excessive irritability. The senile dement objects to any change in his manner of living. He becomes exceedingly egotistical and unreasonable. He makes senseless demands upon his wife and children, and it is not an uncommon occurrence for vicious assaults to be made on them, should they neglect his slightest whim.

The formerly chaste and respected individual becomes intemperate, his conversation is filled with coarse and obscene remarks. Satyriasis is not an uncommon symptom, and this manifests itself in acts of rape, especially on young children, or by disgraceful or bigamous marriages and indecent exposure of person.

I have observed in a hundred and seventy-five cases of rape and attempts at rape that I have studied, that two-thirds of these sexual crimes were committed by decrepit and physically defective individuals, in whom the physical and mental signs of senile decay were evident.

In some instances in senile insanity, there develops a paranoid state with delusions which may be loosely organized or systematized, and accompanied by auditory hallucinations. Consciousness is fairly clear and orientation is but little disturbed. The emotions are exceedingly unstable, and tears and laughter can be alternately produced in a space of a few seconds. Homicides are frequently a symptom of this form of senile insanity.

Regis, in speaking of misdemeanors and crimes of senile insanity, says: "Their actions all carry the stamp of dementia. They are: Absurd and infantile thefts, like those of general paralytics, but even more foolish; sudden and causeless fits of passion; ridiculous and heedless attempts at suicide; there are also especially libidinous actions, obscene exhibitions of themselves in public, attempts at rape, unnatural crimes, all resulting from lack of conscience and absolute loss of the feeling of modesty."

Arteriosclerotic Dementia.—The unlawful acts of this psychosis are essentially the same in character as those of senile dementia, with the possible exception that homicide and homicidal attempts are slightly more frequent because of the paranoid nature of the de-

lusions and hallucinations entertained by this class of patients. Their crimes usually show a little more premeditation, lucidity, provision and foresight to escape the consequencecs of illegal acts.

CEREBRAL SYPHILIS (Fig. 8)

Psychopathic states are likely to develop during any stage of syphilis, but they more commonly occur during the secondary and tertiary periods. They appear in the form of a delirious mania or acute depression. There is a profound disturbance of the moral and emotional qualities. The maniacal excitement may consist of any degree of psychomotor activity ranging from simple cerebral excitement to a state of mania attended by automatic agitation, incoherence and violence. After this state of mental alienation there may follow a mental lethargy and sluggishness, a clouding of consciousness, a defective ideation and a perversion of the sentiments. In the depressed form of acute syphilitic insanity the patient is often exceedingly morose and sullen. He may entertain delusions of persecution, or he may be fearful of poisoning or of secret enemies. The delusions are usually attended by olfactory, gustatory and aural hallucinations.

DRUG PSYCHOSES

Under this title of drug psychoses will be considered the aberrant and disordered mental states due to the use of alcohol, cocaine and morphine.

Alcoholic Insanity.—Alcoholic insanity is a generic term employed to embrace the various forms and types of reaction which follow alcoholic indulgence. We have more or less arbitrarily applied to these different alcoholic reactions the terms acute and chronic drunkenness, delirium tremens, alcoholic hallucinosis, dipsomania, alcoholic pseudo-paranoia, alcoholic pseudo-paresis, alcoholic epilepsy and Korsakow's psychosis.

The disastrous effects of the narcotic, alcohol, on the brain and central nervous system are to be seen every day throughout the civilized world. Acute alcoholic intoxication or the ordinary form of drunkenness, from a psychological viewpoint, is but a transitory form of insanity. As I have said elsewhere: "Both psychologists and

Fig. 6.

Dementia præcox. Crime: Petty but habitual thief.

Fig. 7.

Catatonic dementia præcox. Crime: Assault and battery with intent to kill.

Fig. 8.

Cerebral syphilis. Crime: Assault and battery.

jurists have properly, however, maintained a distinction between those mental disturbances produced by the direct imbibition of alcoholic liquids, and which cease in a few hours after the imbibition ceases, and those mental derangements and hallucinations that may continue for days, weeks or months after all use of alcohol has ceased."

The exact relationship that alcohol bears to crime is problematical and cannot with mathematical precision be determined. I found that 93 per cent. of three thousand prisoners were users of some form of alcoholic beverages, and that 83 per cent. claimed that they used this narcotic to excess, getting drunk at very frequent intervals.

Prison authorities, and especially prison surgeons, know that many prisoners in order to have an excuse for their overt acts, readily attribute their crimes to temporary states of drunkenness. Therefore statistics on alcoholism from penal institutions and reformers are to be taken *cum grano salis,* for they are more or less inaccurate.

Apropos of this subject, Mercier has stated: "The insanity that is most frequently associated with crime, and directly leads to crime in a large number of cases, is undoubtedly the insanity of drunkenness. In nine years, one and three-quarters of a million of persons were sentenced, in courts of summary jurisdiction in this country (England), for offenses committed during drunkenness, and to which the drunkenness contributed, even if it were not, in every case, the efficient cause, without which the offense would not have been committed."

The usual answer that I receive from prisoners during my examination of them concerning the cause of their crimes is generally one of this sort: "I was drunk; I did not know what I was doing; I may or may not be guilty; I cannot remember."

These excuses for crime are so common and so easily made, that the courts are extremely reluctant to place any confidence or value in them. In many instances, however, they are absolutely correct concerning the state of consciousness and memory.

We find in the misty, nebulous mental states that occupy the borderline regions which separate insanity from sanity, conditions of automatism, somnambulism, double consciousness, cataleptic states, conditions of frenzy and furore, all of which are attended by amnesia.

During these apparent dreams states, which are properly due to

disassociation or cleavage of consciousness, every conceivable crime in the criminal category has been committed.

In delirium tremens, murders have been perpetrated by the frenzied alcoholic under the delusion that those about him are his enemies. Suicide is not an infrequent termination of this form of alcoholism. The dilapidated, deteriorated mental state of chronic alcoholism is conducive to crime, for the moral sense is perverted, the will-power is practically inert and the individual becomes the abject slave of his own passions.

The crimes of acute alcoholism are petty thefts, larceny, forgery, rape, incest, sodomy, assaults and homicides. Petty thefts, obscene exhibitions and sexual crimes have all been noted in alcoholic pseudo-paresis.

Alcoholic hallucinosis, which is attended by persecutory delusions of a sexual nature and by hallucinations, especially of the auditory variety, leads to homicide and homicidal attempts.

I have observed that a large number of wife murderers committed their crimes when reacting to delusions of marital infidelity.

The same crime producing delusions and auditory hallucinations are characteristic of alcoholic pseudo-paranoia. We usually find dipsomania to be dependent upon neuropathic heredity, diseased conditions brought about by trauma, malnutrition and lack of proper food. The inebriate is, in fact, a diseased person, and 70 to 80 per cent. of them have a defective heredity. Deviations from the normal become more noticeable with accurate and scientific measurements.

It will be well to review briefly the attitude and beliefs that society has entertained concerning alcoholism and responsibility.

Lord Coke of England set forth the idea in his ruling in the seventeenth century that drunkenness and inebriety augmented a crime or misdemeanor and therefore called for an increase of punishment.

For many years moralistic speculation and theories have determined in a large degree the attitude society has held toward drunkenness.

The reformers and philanthropists have ever held the inebriate morally responsible. They have endeavored fruitlessly to rehabilitate the dipsomaniac by moral suasions, recriminations, insults and punishments.

It cannot be denied that moral treatments do exercise some influence in cases of inebriety, but they should always be secondary to medical and hygienic measures.

Doctor Crothers, America's leading authority on alcoholism, convincingly states, relative to this phase of the subject, the following: "It is a delusion to interpret acts associated with premeditation and reasoning in inebriates as evidences of sanity. It is a delusion to consider inebriety and alcoholism as not impairing the sanity and integrity of the brain and body. It is a delusion to consider such persons as possessing free will and judgment, with consciousness of their condition and ability of control. It is a delusion often repeated and has become incorporated in jurisprudence, that alcohol may be used to give capacity to commit crime. In reality this is true, but in a very narrow limit.

"The exciting stage following the use of alcohol might be limited to ten minutes or an hour, but after that there is no certainty that any act premeditated could be carried out. The fact is sustained by unmistakable evidence that all crimes committed by such persons are the acts of defective minds. All this signifies a recognition of the condition of the criminal, not to diminish the punishment, but to change it to more rational lines. Criminals of this class need control, care and changed conditions. They are clearly defectives and degenerates who have lost the power of rational thought and conduct."

The positions taken by our courts on the subject of intoxication are contradictory and illogical. If an individual in a state of intoxication makes a will, signs a contract, a deed, a promissory note, or a bank check, the courts of law do not hold such papers and testaments as valid or legal if a proof of intoxication can be brought to bear. Law in this case questions and even denies the responsibility and the capacity of an intoxicated individual to execute a legal instrument.

In the practice of criminal law this is quite the reverse. If a drunken man commits a crime while intoxicated he is held to be responsible and qualified to commit a crime. Yet psychologically and physiologically, the mental impairment, the lack of reason and judgment, the incapacity to act normally are just the same whether an offense be committed against criminal or against civil law. Our conceptions concerning alcoholism and responsibility must change.

Society in general and law in particular still look upon an individual as the possessor of an absolutely free will. Can we look upon intemperance as *prima facie* evidence of deliberate viciousness? This is hardly possible in the light of recent research.

It has been demonstrated beyond the shadow of a doubt that the dipsomaniac is always a neurotic. His nervous system is impaired by heredity, disease or trauma. The defects of his brain and central nervous system produce at intervals an insatiable, uncontrollable craving for alcoholic stimulants.

Morphinic Insanity.—The medico-legal aspects of the narcotic drug habit need to be more carefully studied than they have been in the past. Eight per cent. of the 5000 prisoners examined at the Indiana State Prison were users of cocaine, morphine or other narcotic drugs. Fully 5 per cent. of all the crimes for which prisoners were committed to this institution were due directly or indirectly to the use of these agents.

The victim of morphine insanity is absolutely a slave to the almost insatiable desire that possesses him to use opium or any of its alkaloids. The moral degradation and misery of oxymorphinism will lead the *habitué* into the performance of any crime in his efforts to secure morphine. The drug victims will commit larceny, burglary, forgery, arson, blackmail, homicidal attempts, murder and sexual crimes to satisfy their morbid cravings.

Women have many times been known to prostitute themselves to secure the drug. A very large percentage of the commercial prostitutes are morphinomaniacs. The psychotic disturbances of morphinism frequently develop a depressive and melancholy character, and these are attended by delusions of persecution and a tendency to suicide. Occasionally states of incoherence, confusion and mania are observed, during which periods homicidal attempts are frequently made.

Police Surgeon Doctor Guimball, who has had a wide experience with criminal drug *habitués,* says the following: "First, morphine causes defects of attention, particularly of sense observation; second, the ethical sense * * * is blurred. The victim is unable to discriminate any moral basis that should dominate. He acts from impulse; third, his will is lost and power of control over the impulses

lessened. Both physical and mental impulses dominate him from the slightest exciting causes; fourth, the morphinist is literally a lunatic, only more subtle and concealed; like the dipsomaniac he is liable to be dominated any moment by impulses that are unforeseen; fifth, the responsibility, like judgment, is impaired and enfeebled. He is constantly doing acts and saying things the import of which he does not understand."

Cocainism.—The criminal manifestations of cocaine insanity are essentially those of morphinism, except possibly that they are slightly more profound. The cocainists as a rule are very easily irritated, and their conduct is largely governed by violent impulses. Pronounced changes in their characters take place; the patients become dishonest and deceitful and seem to possess a morbid propensity for lying. The will-power is markedly enfeebled; all sense of moral or legal responsibility is weakened; reason and judgment are greatly impaired.

The development of a paranoid state is a very common occurrence. The victim develops and entertains delutions of a persecutory nature; he becomes suspicious of his wife's attitude toward other men. Frequent homicidal assaults grow out of these delusions of marital infidelity. Erlenmeyer has observed that the sudden withdrawal of the drug from the cocaine fiend often induces a profound state of depression and delirium which is accompanied by persecutory delusions that render the individual an extremely dangerous person. Suicide is not an infrequent termination of chronic cocaine intoxication.

The psychotic states dependent upon the chronic use of such narcotic drugs as cannabis indica, sulphonal, veronal, hyoscyamus, chloral, bromides, ether, chloroform, belladonna, lead, arsenic and mercury, are usually acute or chronic confused paranoid conditions attended by delirium.

TRAUMATIC PSYCHOSIS AND TRAUMATIC PSYCHOPATHIC STATES

The term traumatic insanity has been applied to a certain group of psychotic symptoms of more or less definite clinical character, the origin of which may be traced to some injury to the head or spine. The psychic symptoms occur more often in those cases in which there

has been an extensive injury, great pressure or concussion to the brain substances, than in those in which the cerebral injury is restricted to a single limited area.

The mental symptoms following a head injury may be of two kinds, namely, those of a delirious state, and those of a condition of feeble-mindedness. Crime more frequently occurs during a condition of traumatic feeble-mindedness rather than it does in the state of traumatic delirium.

Immediately following an injury to the head or spine there may develop a state of unconsciousness which lasts a longer or shorter period of time. When consciousness is regained, the patient usually fails to remember anything of the accidents or happenings that occurred a short time before. Ordinarily after the injury the subject is soon restored to normal, and for weeks, months, or even years, he may not display any signs of mental failure.

The first symptom of mental disorder that is noted is an insidious change in the patient's disposition. He becomes egotistical, irritable, fault finding and morose. He has periods of despondency and depression. He worries about his health, financial matters and kindred affairs. His moral sense is weakened. Judgment and reason are impaired, violent outbreaks of temper occur, and to allay his unpleasant and distraught feelings he often resorts to the excessive use of alcoholic beverages, to which he shows a pathological reaction.

The psychopathic state just described creates a most favorable disposition for the perpetration of crimes and misdemeanors, and the instances are by no means rare in which violations of the law show their direct origin to cerebral trauma.

FEEBLE-MINDEDNESS (Figs. 9, 10, 11 and 12)

The greatest causative mental factor of crime is feeble-mindedness. Several divisions of mental defect have been made, and while they are more or less arbitrary, they are very useful for the purposes of description. As we are only concerned with the symptoms of feeble-mindedness that relate to crime, no other symptomatology will be described, the more especially as the subject matter has been gone over so capably and thoroughly by Dr. E. Bosworth McCready in the last issue of the INTERNATIONAL CLINICS.

Fig. 9.

Feeble-mindedness. Crime: Rape.

Fig. 10.

Feeble-minded boy. Crime: Rape

Fig. 11.

Feeble-mindedness. Crime: Arson.

Fig. 12.

High-grade feeble-mindedness. Crime: Theft.

Fig. 13.

Constitutional psychopathic inferiority. Crime: Robbery.

Fig. 14.

Sexual pervert (paranoid dementia præcox) Crime: Sodomy and theft.

Brutality and cruelty seem to be universal symptoms of imbecility. The precocious cruelty of the feeble-minded which enables them to torture animals, to cripple birds, to tear the wings and legs off insects, to laugh at the pain of others, to inflict torture with delight, forms the basis, when they are physically able, for assault and battery and for homicidal attempts and murder.

The easy disintegration or cleavage of consciousness which occurs so often in the feeble-minded permits violent explosions of anger against those who interfere with their pleasure. Their wrath is shown by outbursts of fury and frenzied attacks; again it is exhibited by well-calculated and cunning cruelty.

The feeble-minded, lacking in reason and judgment and devoid of all moral critique, commit all manner of sexual crimes without any feeling of restraint or shame. They masturbate openly and excessively. The imbecile father impregnates his own daughter, or he may commit sodomy with his own son. Imbeciles may attempt intercourse with their mothers, and bestiality is frequently attempted. Many of the attempts to murder, and murder itself, committed by the mentally defective, are perpetrated when the person attacked resists their erotic assaults.

Often they are cunning thieves; articles of small worth seem to have a great attraction for them. To satisfy their vanity, they often steal wearing apparel. They set fire to property to appease their desire for the excitement which attends conflagrations. Many of the pyromaniacs who are a constant source of worry to the fire insurance companies are feeble-minded persons.

Quoting again from a previous paper of mine:

"Higher imbeciles are predisposed to systematized delusions, and more particularly to communicated insanity. Imbeciles are the near neighbors of paranoiacs and are apt to pay tribute to them by blindly professing their delusions on the occurrence of the slightest opportunity.

"When a paranoiac is a propagandist of mystical ideas, and reigns as a sovereign or high priest, it is the imbeciles who compose his court and form the majority of his subjects. (Jacoby.) The contagion is favored by the affinity of tendencies in paranoiacs; every paranoiac is mildly imbecile, and every imbecile is at least a candidate for

endemic paranoia if he lives in isolated and fanatical surroundings. * * * In epidemics of religious and political delusions, it is among imbeciles that spies and traitors are most easily found. Their want of critical power, their fickleness of character, and the servility that drives them to become the apostles and slaves of paranoiacs, whose ideas they do not understand, lead them also to surrender when intimidated by warnings, flattery and threats. Their intelligence is equally incapable either of originating a delusion or of spontaneously correcting a delusion; but it is accessible to the positive and negative suggestions of others, and does not appreciate how compromising it is to suddenly abandon a principle.

" In the moral point of view the lacunæ are perhaps more marked than in the domain of the intellect, and if these patients are capable of showing to varying extent sentiments and affections of a low order, they are only the least elevated ones, and the lower instincts that dominate them. The majority are vain, gluttonous, cowardly, credulous, idle, irascible, inclined to venereal and alcoholic excesses and to acts of violence; (Marce) nearly all are given to onanism, and some to unnatural crimes. At certain times they may be seized more or less suddenly with melancholic or maniacal attacks, during which they are particularly liable to commit acts of obscenity, or even arson, robbery, suicide, or homicide. When these attacks, which very often assume in them a periodical or circular character, occur many times, the patients soon fall into a condition of dementia."

Alcohol plays a very important rôle as an element for the production of crime in the feeble-minded. It serves to intensify the defect already existing, it weakens the already enfeebled volitional powers; it is influential in firing misguided, wild and erratic emotions. It distorts previously inefficient and irrational judgments. In fact, it raises to the nth power all potential and latent elements for criminality that lie in the constitution of the feeble-minded.

Feeble-minded Prisoners.—I have classed 23 per cent. of the criminals whom I studied, as feeble-minded. In the employment of this term I have endeavored to limit its application to those persons who as a group possess " all degrees of mental defects due to arrested or imperfect mental development as a result of which the person so affected is incapable of competing on equal terms with his normal

fellows, or of managing himself or his affairs with ordinary prudence." This, in the language of the American Association for the Study of the Feeble-minded, is necessary for the diagnosis of feeble-mindedness.

Various estimates have been made by different psychologists and physicians as to the number of feeble-minded persons in penal and reformatory institutions. This number has varied from 20 to 60 per cent., and these differences can be easily understood when we consider the various natures of the institutions giving this data and the general broadness or narrowness of the psychopathological examination employed in such determinations.

Dr. Walter Fernald has stated: "At least 25 per cent. of the inmates of our penal institutions are mentally defective and belong either to the feeble-minded or to the defective delinquent classes.

"At that rate we should have twenty thousand such individuals in adult prisons, and six thousand in juvenile reformatories, making a total of twenty-six thousand defective delinquents in actual custody, not to mention those who have never been arrested and the large number who have been discharged or paroled from institutions and are now at large. There are doubtless as many defective delinquents at large as there are in custody."

PSYCHOPATHIC PERSONALITIES AND BORDERLINE STATES

There is a group of psychopathic individuals whose mentalities lie in that ill-defined state where sanity shades imperceptibly into insanity, where the markings between responsibility and irresponsibility are hazy, indistinct and confused. Because of this lack of mental equipoise, they are potential lunatics or criminals.

These persons constitute a very much greater portion of the defective delinquent class than do the criminals of the positive psychoses.

For purposes of description the individuals of this type have been variously designated as psychopaths, constitutional inferiors and sexual perverts, and they will be briefly described.

The psychopaths constitute a group of individuals who may be said to be "semi-insane or semi-responsible." The following is a description of the psychopath by Doctor Parker: "In the psychiatric sense he is neither flesh nor fowl, neither sane nor insane, and he is a dangerous individual at every stage. He is bright, responsive, reactive and

in a varying degree adaptable for certain periods. He is anti-social, either for brief periods or persistently."

There are individuals who display many eccentricities of character and conduct. But these characteristics seem to be no departure from the individual's usual manner of feeling, thinking and acting, nor are they sufficient to warrant calling the individuals who possess them insane. Yet these characteristics in question hinder the efficient adjustment of the individual to his environment. It is noted that a positive insanity is a very frequent development in these cases. They have been graphically described by Regis as follows: "Their lives are one long contradiction between the apparent wealth of means and poverty of results."

Their mental twists, so to speak, make it impossible for them to live at ease in their environment. Their distorted mental perspectives lead them to magnify the wrongs they see in the social organism. They are dreamers, reformers, propagandists and curbstone socialists; and should they come into conflict with the law, they assert that the wrong lies with society and its laws and not with themselves.

The psychopath is often the victim of obsessions and imperative ideas. While in the majority of cases they are limited to harmless results, so far as society is concerned, they may occasionally lead to the performance of criminal acts.

CONSTITUTIONAL INFERIORS (Fig. 13)

The largest single group of criminals that I have studied may be classified under the term "constitutional inferiors." The term is self-explanatory. While the individual of this group is not feeble-minded in the strict sense of the term, he is below par either physically or mentally. He is unable to stand the strain imposed upon him by the ordinary conventions of society. Without assistance he cannot occupy the place that he should in the social order. Indecision, inability, vacillation and dependency are his chief characteristics. He readily takes to every vice that comes across his path, he indulges in prostitution, and falls an easy victim to the drink and drug habits. His mental operations are slow or inaccurate; his reason and judgment are defective. The constitutional inferiors possess an unsatisfied craving for continual and unusual excitement, and in their impetuous endeavors to secure it they live on the borderline of

insanity and criminality, over which they are swept back and forth by the force of tempting circumstances in which they often find themselves. In them the call of the *Wanderlust* is particularly strong; they travel from place to place. Railroad employees and detectives in particular can testify to this fact. With the coming of warm weather, hundreds of them traverse the continent in search of contentment, which leads them a never-ending chase. Many of them are convicted of petty crimes, and a very common one for them to commit is the breaking of box-cars to secure food and small plunder.

The treatment to be attempted in this class of cases is the removal of those physical conditions brought about by dissipation and venereal diseases, removal from vicious and bad associates, reëducation and tactful direction of their thoughts and activities into channels of usefulness. If it were possible to transform their restlessness and unproductive activity, and if employment could be secured that would in a measure afford them novelty and excitement, their rehabilitation might be expected if it were not for their neuropathic organizations.

There are to be found in this constitutionally inferior class of persons a group of individuals to whom the term pathological liar can be applied with a marked degree of descriptive accuracy. This tendency to excessive prevarication has its origin in the higher types of mental defect and especially in those cases where there is a marked degree of emotional instability and a lack of mental equilibrium.

These individuals are the gossips of the prison. They seem to take a particular delight in spreading unfounded, senseless rumors and falsehoods about the institution. They are sincerely hated and distrusted by the other prisoners. Very often they make confessions of crimes which they never committed, merely to gain notoriety and the attention of prison officials.

In one instance there came under my notice one of these morbid liars who made a confession that he had committed a murder. He was in reality not guilty at all, but on the strength of his confession he was convicted in court and sentenced to life imprisonment.

SEXUAL PERVERTS (Fig. 14)

There are very many sexual perverts to be found outside of penal institutions and hospitals for the insane. We are concerned here only with those sexual anomalies that show a direct relationship to the

crimes of rape, incest, sodomy and necrophilia. It is to be understood that certain other inversions and perversions of the sexual instinct lead to various other crimes. Murder has often been the outcome of sadistic practices.

Not all expressions of homosexuality are to be regarded as evidences of insanity, yet it may be safely said that the majority of sexual perverts are psychopathic. Sexual perverts of the most disgusting types are found among the psychopaths.

Whether these anomalies of the sexual instinct are always congenital or not has not been settled, and it does seem that inverse and perverse sexual habits may be acquired early in life through vicious and depraved associates. The sexual perverts are at any rate an exceedingly dangerous and demoralizing class which should be permanently isolated.

Sodomy is not an infrequent crime among prisoners. About 1 per cent. of the prisoners examined were convicted of this crime. A most strict and constant supervision is kept over the prisoners by the prison officials to prevent this practice, and in those prisons where more than one inmate is housed in a cell extreme caution must be exercised.

Approximately 2 per cent. of the prisoners examined in this survey were guilty of incest. But it no doubt occasionally happens that a man convicted of incest is innocent, and that blackmail, hysteria and fraud play a part in such convictions.

Four and eight-tenths per cent. of the prisoners who were considered in this survey were convicted of rape. The average age of the men who were convicted of rape was forty-four years plus. Ninety per cent. of them showed disorders of the nervous system and an increase or decrease of the tendon reflexes and a general condition of arteriosclerosis; 73 per cent. of them were married men in whom the habit of frequent intercourse was established; 60 per cent. of the cases of statutory rape were committed by men over fifty years of age.

Nutritional Problems

A CONSIDERATION OF DEFICIENCY DISEASES: DISEASES RESULTING FROM FAULTY DIETS *

By JOSEPH GOLDBERGER, M.D.
Surgeon, U. S. Public Health Service

Of the advances in science that will mark the first quarter of the twentieth century none is of more fundamental importance to mankind than those in the domain of chemistry by the application of which an animal may be successfully fed on a synthetic diet throughout the normal span of its life.

As is well known, it was long believed that protein, carbohydrate, fat, inorganic salts and water were the essential dietary components. Singularly enough, however, all attempts to carry this belief into practice by feeding experimental animals on such purified nutrients sooner or later ended in failure. This led to the suggestion being put forward, first by Lunin in 1881 and later, independently and more definitely, by Hopkins (in 1906) that there must be dietary factors other than these basal constituents.

These suggestions which, curiously enough, attracted very little attention at the time, had their origin in purely biochemical studies of nutrition. Contemporaneous with them, studies were in progress in the domain of pathology the results of which pointed to exactly the same thing, for the investigations started with and stimulated by the pioneer researches of Eijkman (1897), of Grijns (1901) and of Braddon (1907) in beriberi, and of Holst and Frolich (1907) in scurvy, indicated quite clearly that these diseases were intimately associated with diets lacking some unknown factor.

It is almost exactly ten years ago that Funk advanced the view that the diseases beriberi, scurvy, pellagra and possibly rickets constituted a group of "deficiency diseases," the primary etiological factor in each of which is a deficiency in a substance of a new class

* Opening paper presented by invitation in a symposium on "Nutritional (Deficiency) Diseases" at the Medical Society of Virginia, Norfolk, Nov. 1, 1922.

named by him vitamin. The experimental proof that converted this hypothesis into fact, so far, at least, as beriberi and scurvy are concerned, is the fruitful result of the researches of the recent past. As a result it is now accepted that beside the food factors known of old there are essential for mammalian nutrition at least three others now commonly referred to by the name suggested by Funk.

Doubtless by reason of their novelty and their mysterious character the vitamins have attracted an extraordinary amount of attention, both from the profession and the laity. Indeed, so much has this been the case as to make it almost seem as if these were the only dietary factors of importance, and to have led many hastily to assume that any and all nutritional disturbances, or disturbances only suspected of a nutritional origin, must be due to deficiency in factors of this class.

The purpose of this paper is to point out briefly the essential nature of the so-called deficiency and related diseases and to invite attention to the need of a broader conception of these than now commonly obtains. Time will not permit much detail nor the consideration of other aspects of these disturbances such as their relation to the endocrines, an aspect, by the way, that tends to evoke discussion of a volume inversely proportional to the mass of available fact.

It will be helpful to an understanding of the "deficiency diseases" to, first of all, consider briefly some of the more outstanding characters of the substances, the existence and need of which have only just been recognized.

It has already been mentioned that the existence of three vitamins is now well recognized and accepted. These are specifically designated as vitamin–A, vitamin–B, and vitamin–C respectively. Within the past few weeks evidence has been brought forward by McCollum and associates of the existence of a fourth which, if confirmed, will, under existing nomenclature, be designated as vitamin–D.

These complexes are widely, but quite unevenly, distributed among our natural foodstuffs. Thus, to consider a few typical examples, the whole corn kernel contains considerable vitamin–B, a little vitamin–A, but no vitamin–C; the ordinary dry legume seeds, beans and peas, are very rich in vitamin–B but are devoid of both A and C. Spinach is reported to contain some vitamin–B and much of A, while raw cabbage and tomatoes contain all three, but are particularly rich in C.

Originating primarily by synthesis in plants the vitamins are present in animal tissues and secretions, with rare exceptions, only as the animal secures them in the food, herbivores directly and carnivores indirectly, from the plant. In animal, as in vegetable foods, the distribution of these essentials is very uneven, the efficiency of the different organs and tissues as reserve depots apparently varying markedly. Milk has been found to be notably rich in vitamin–A but to contain relatively only moderate or only small amounts of B and C; muscle meat contains all three vitamins, but in very small amounts; whereas such organs as the liver and kidney are very rich in both A and C and only moderately supplied with vitamin–B. It is of great practical importance to recognize that this naturally occurring inequality is frequently accentuated and greatly modified by the treatment (milling, heating) to which many of our foods are subjected and which has arisen as a result of the practical necessities of distribution and marketing of present-day civilization.

Chemically still unidentified, the vitamins are recognizable at present only by the pathological results of their withdrawal or absence from the diet. An inadequate supply of any one of them is followed by disturbances shown in experimental animals by a more or less marked reduction in appetite, retardation or cessation of growth, and, sooner or later, nutritive failure. Besides these general symptoms, an inadequate supply is also followed by certain effects more or less distinctive of each; thus, deprivation of vitamin–A, if of sufficient degree, may lead to ophthalmia—the xerophthalmia of McCollum; of vitamin–B, to nerve degeneration with disturbed sensory and motor nerve function and symptoms of polyneuritis; and deprivation of vitamin–C to hemorrhages, particularly subperiosteal and along muscle sheaths. Vitamin–D, if it be not premature to so designate it, is concerned in calcium metabolism. A deficiency of this substance in connection with a faulty calcium-phosphorus ratio in the ash of the diet when coupled with inadequate sunlight leads to disturbance in calcium deposition in growing bones.

The syndromes thus resulting in animals are the analogues respectively of keratomalacia, beriberi, scurvy and rickets in man. Incidentally it may be remarked, in view of the continued agitation in some quarters against animal experimentation, that our knowledge of the etiology of these diseases of man, so long obscure and per-

plexing, is now solidly founded on the result of experimental study of the corresponding condition in animals. And the possibility of substantial further progress depends directly on the possibility of further animal experimentation.

Let us now consider these diseases individually with respect to the dietary factor specifically concerned in their etiology. The dependence of keratomalacia on vitamin–A deficiency is so well established by recent studies that discussion of it at this time would seem to be unprofitable. Reference may well be made, however, to a clinically similar eye condition in rats, recently described by McCollum and associates, found to be due not to vitamin deficiency but to a faulty mineral balance, particularly with respect to chlorine and sodium. The possibility that an eye condition may occur in man analogous to this newly discovered one in rats makes this of importance to the clinician.

Beriberi and scurvy are the classical types of vitamin deficiency diseases. The former arises as the result of a deprivation of vitamin–B, the latter of vitamin–C. The occurrence of the former has most commonly been associated with a diet in which white, highly milled rice was an unduly large element; the latter with a diet in which fresh vegetables formed an unduly small element. All this is now so well known that simple mention of these broad general facts is all that is called for.

The status of rickets as a vitamin-deficiency disease is, however, on quite a different footing. Mention has been made of the fact that a factor probably of the nature of a vitamin, which may tentatively be referred to as vitamin–D, may play a part in the development of this disease, but it should here be made clear that this relation differs in a fundamental respect from that which obtains between vitamin–B and beriberi or vitamin–C and scurvy. In rickets the part played by the vitamin, if such should indeed prove to be the nature of this factor, is not, as in beriberi and scurvy, under all circumstances an essential one. In rats, at least, it appears to be needed only, as has already been mentioned, when there exists a faulty balance between calcium and phosphorus in the diet and then only in circumstances of insufficient light. Indeed, some students of the disease regard this insufficiency of sunlight as the fundamental factor in the origin of

the disease, basing themselves largely on the fact that the greatest incidence of the disease is in the late winter and early spring, that is, at the end of a season of reduced sunlight. But the absence of the disease in certain northern latitudes (New Hebrides) under circumstances of but little light during long seasons, the greater incidence in artificially than in breast-fed children, together with the experimental evidence now at hand points, in our judgment, to diet rather than to light as the primary controlling factor. In either case, it is clear that rickets cannot properly be considered a vitamin-deficiency disease. And what has been said of rickets probably applies fundamentally equally to osteoporosis and to the hunger-osteomalacia observed since the war in Austria.

Besides the diseases that have been so far considered a number of others have from time to time been mentioned as dependent on vitamin deficiency. Among the most conspicuous of these are tropical sprue and pellagra.

There is much to justify the opinion long held by some observers that an important relation exists between diet and sprue. Perhaps most significant in this connection is the high esteem in which the dietary treatment of this disease is held by practitioners in the tropics. There is practical unanimity among them as to the outstanding value of a diet of milk or meat, or of a combination of these with fruit—particularly strawberries. But even if it were justifiable to accept this as proof of a close relationship, and indicative of dietary deficiency, one could hardly do more, on the basis of the meagre evidence at hand, than guess as to just what specific dietary factor or factors are involved. If we were to venture a guess, the striking resemblance of its symptoms to some of those of pellagra would lead us to suggest that the etiological dietary factors in sprue may possibly prove to be of a nature similar to those in pellagra. In connection with sprue, passing reference may be made to "Coeliac Disease," a condition in children first described nearly fifty years ago by Samuel Gee and quite recently carefully studied by Still. Clinically it resembles sprue in several striking respects, but the etiological factors are so obscure that little more can be said than that it is not unreasonable to expect that the condition will prove to be of dietary origin; it is pure speculation, however, to talk of vitamin deficiency in relation

to it. This applies with even more force to another even more obscure condition in children, reported in this country in the last year or two under the names "acrodynia" (Weston) and "pellagra-acrodynia" (Byfield), but in all probability identical with the "erythrœdema" first described in Australia about eight years ago (Wood). Much careful study, clinical, epidemiologic and dietary, of all these conditions will have to be made before even their broad dietary relationship can be postulated other than most tentatively.

The relation of diet to pellagra was, until quite recently, as obscure and doubtful as it still is to sprue. But the results of investigations carried on during the past seven or eight years have gone far towards clearing up this well-nigh two century old problem.

Evidence has been brought forward which indicates that diet operates as the dominating factor in controlling the clinical course and outcome of an attack of this disease. Furthermore, the results of experimental feeding on a considerable scale of pellagrous children in orphanages and of pellagrous insane in a hospital for insane warrant the conclusion not only that diet controls the course of the immediate attack but also that the clinical recovery thus brought about continues and no new cases develop so long as a proper diet is maintained—and this without the intervention of any other factor, hygienic or environmental. This pellagra-preventive effect of diet, it may be noted, is represented not merely by a more or less marked lowering of incidence but actually by a complete disappearance of the disease. In this respect it has striking analogues in such diseases as beriberi and scurvy, in which the same notable phenomenon has long been well known.

Just as in treatment and prevention, so directly in the causation of pellagra the available evidence points to diet as the controlling factor. Considering only the direct experimental evidence we find that all reported attempts to induce the disease by means other than diet have failed, whereas in a controlled human feeding experiment with a diet the outstanding character of which was a protein supply derived almost entirely from a mixture of cereals—maize, wheat and rice, not less than six of a group of eleven men who submitted to it developed the disease (Goldberger and Wheeler).

Since an adequate increase or a liberal addition of milk and lean meat to a pellagra-producing diet, without other modification will

prevent the occurrence of the disease, it is thus clearly suggested that in pellagra we have the manifestations of a dietary deficiency. With respect to the dietary factor primarily concerned in this deficiency the evidence has for some time increasingly tended away from vitamins, and, as we shall presently see, some observations recently made by us (in association with Dr. W. F. Tanner) well-nigh, if not absolutely, eliminate the known vitamins as essential factors.

In the course of our study of the prevention of pellagra in a section of Georgia State Sanitarium we noted the occurrence of a number of cases of the disease in individuals who, during a period as long as three or four months before the onset, had daily consumed a diet the vitamins in which were derived from a considerable variety of vitamin-rich foods, including cod-liver oil and baker's yeast, that in the aggregate must have supplied an abundance of these complexes. This diet is believed to have afforded also a liberal supply of minerals since it included a supplement of mineral solutions yielding approximately the mineral elements of the ash of a litre of milk. Under these circumstances it would seem permissible to exclude vitamins and minerals, thus leaving, of known factors, but protein for consideration as the essential primary one involved in the deficiency.

This interpretation is very greatly strengthened by the indications afforded by another case recently observed by us (in association with Dr. W. F. Tanner). This was in a colored patient who developed an attack of pellagra after three months on a diet which, so far as could be judged, was so constituted that, if faulty, the fault was most probably connected with the protein which was derived practically exclusively from twenty-four ounces of milk. After nearly three weeks of a progressive development of symptoms a preparation at first of calcium caseinate, later of a high-grade casein, was added to the diet and the fresh milk replaced by an equivalent volume of skim milk in powder form, thus bringing about, significantly, only an increase in the protein. This modification was followed by prompt clinical improvement although the previous progress of the case and experience with some other similar cases had impressed us that no amelioration of symptoms was to be expected without an appropriate change in diet.

The indication is, therefore, very strong that the dietary deficiency is one involving not vitamins and minerals but protein,

and, since the present-day conception regards protein as a complex of amino-acids, that it is some amino-acid deficiency that constitutes the primary specific factor [1] in pellagra. We have here, in all probability, therefore, a type of deficiency disease fundamentally different from that represented by beriberi or scurvy.

It thus becomes evident that the conception of deficiency diseases must be extended to include this probably new type represented by pellagra. But recent developments in our knowledge of another disease, one ordinarily scarcely thought of in this connection, seems to us to suggest that this extension should be carried still further.

The etiology of endemic goitre has long been obscure, but the work of Marine and associates seems to us to indicate with increasing clearness that this condition arises primarily from an inadequate ingestion of iodine. Marine's demonstration in school children of Akron, Ohio, confirmed by Klinger in Switzerland, that this condition can easily be prevented by the administration of a small amount of sodium iodide appeals to us as in the highest degree suggestive, if not entirely conclusive. But whether this view of the etiology of endemic goitre is as yet entirely acceptable or not, it nevertheless serves to indicate that serious consideration must be given to the possibility, if not the probability, that deficiencies in the mineral factor in diet may give rise to more or less specific pathological conditons in man.

Accordingly, it would seem advisable to further extend the conception of deficiency diseases so as to include those due to mineral deficiencies, of which endemic goitre may, at least tentatively, be regarded as a type.

This broader conception would thus include all of the diseases that we have seen to be dependent on deficiency of an essential dietary factor. It does not, and, in the light of the evidence at hand, should not include rickets, for, as has already been pointed out, if we accept the dietary view, this arises primarily not from a deficiency but from a faulty balance of the mineral elements of the diet. As we see it, then, we have in rickets a disease of dietary origin, which is related to the deficiency diseases but is not strictly one of them.

[1] This does not exclude the possibility, indeed the probability, that other factors, dietary and non-dietary, may (perhaps frequently do) operate either to accelerate or to retard the action of the primary factor.

This suggests the desirability of a grouping broad enough to include the dietary deficiencies and also such related diseases as rickets. Fundamentally all these conditions, including rickets, arise in consequence of faulty diet, and it would thus seem entirely rational to bring them together on this basis as diseases arising from faulty diet.

Such broad classification appeals to us as having rather important advantages. In our review of the individual diseases arising from faults in diet reference was made only to the primary distinctive dietary factors, but this is not to be understood as indicating that other dietary factors are never involved. Quite the contrary is certainly frequently the case. This may be deduced from the newer knowledge of the dietary properties of our foods which indicates that a diet faulty in one respect is almost certain to be defective in some degree in other respects, and this is borne out clinically by the occasional occurrence of cases in which there may be observed an association of scurvy with rickets, of scurvy with beriberi, of pellagra with beriberi, or of scurvy with pellagra. It follows, therefore, that almost always the diet associated with a specific clinical condition, whatever it may happen to be, may be expected to be faulty not only with respect to the factor that gives the clinical entity its distinctive character but, in some degree, also with respect to one or more other factors. Such condition is therefore more accurately described as a disease of faulty diet than as a deficiency of this, that, or other factor even if all the defects were of the nature of deficiencies.

This broader classification avoids the implication, that otherwise may appear to be suggested, that the primary specific factor is the one exclusively concerned in bringing about the clinical condition as it actually presents itself. It thus permits of a more ready appreciation of the fundamental importance of a diet adequate in all respects, for it tends to suggest that in dealing with such diseases attention must be given not alone to some one specific factor but also to the make-up of the diet as a whole.

In closing it is desired particularly to emphasize one thing that emerges from this discussion, namely, the dominant importance of a properly constituted diet. Such a diet is essential not only in treatment and prevention but also in the promotion of the highest physical development and vigor of which the race is capable.

SOME COMMENTS CONCERNING VITAMINS

By WILLIAM EGBERT ROBERTSON, M.D.,

Professor of Medicine in the Medical Department of Temple University, Philadelphia

---

Much is already definitely understood as to the etiological relation of vitamins to certain disease entities and syndromes, but we meet with many body disturbances which seemingly depend upon food factors, about which we know as yet little or nothing, such as the asthenias associated with anorexia, perhaps best illustrated by that peculiar condition called anorexia nervosa, or, going to the other extreme, and more easily dealt with, theoretically at least, the conditions resulting from excess food or excess of certain types of food, as seen in the obese, the potential diabetic, and perhaps I am justified in adding, the hypertension patient. Yet when we come to apply what knowledge we possess, who can say that we can successfully prescribe for a case of hypo- or hypertension, or, granting the value of the water soluble vitamins as appetite stimulants, we soon reach a state of disappointment and dissatisfaction, in adults certainly, less so in those whose growth is incomplete, when we attempt to re-establish the balance of growth and nutrition.

To the practising doctor, no better instance of the value of food substances is presented than in the typhoid case. During the active infection, even though the patient be allowed and may take 2000 or even 2400 calories a day, there is more or less progressive loss of flesh and strength, less of course than in those subjected to the former and really cruel plan of relative starvation. As soon as the active phase has subsided, however, convalescence and gain in weight are very rapid in those properly and hence sufficiently fed, and this is especially true of those to whom a liberal caloric diet has been given during the course of the infection. To bring home the importance of foods both as tonics and reconstructives, I often say to patients, "You cannot buy good health in the drug store." This sometimes carries conviction, and makes the problem of diet one more readily dealt with, for it cannot be denied that the public has not yet been educated to the

importance of food in health or in disease. It is often astonishing how much can be done for the obese heart patient, with or without an endocarditis, by a sufficient but restricted diet. When it comes to the utilization of vitamins, however, except in a limited sense, we enter deep water.

To Casimir Funk we owe our knowledge of vitamins as specific food factors, though many had tilled the field before him and suspected their existence. He named them vitamins because he found them to be nitrogenous, amine containing, and because he found them to be of vital importance. He also gave us the terms, avitaminoses or deficiency diseases, comprehensive names applied collectively to those diseases or syndromes arising from a deficiency of vitamins.

Beriberi was the first of the deficiency diseases to be studied physiologically and chemically, hence leading to the discovery of vitamins. The disease had been known to exist in Japan for over 1000 years, and in Brazil, quoting Lovelace, Funk says it had existed at least 250 years. He says the disease occurred only occasionally in the warmer climates and among rice-eating people, until toward the end of the nineteenth century, when the relative oriental isolation was forever disrupted by the penetration of the white race. Soon after the influx of Europeans, it was noted that beriberi spread in an amazing fashion, both in numbers and geographically. It was soon noted that among the natives, who clung to the hand-mill process of treating rice, the disease only arose sporadically, but with the introduction of machine milling of rice by the Europeans, where such rice was used as the staple diet, the disease spread rapidly and the mortality was considerable. It did not take long, when the above fact had been recognized, to determine that with the more thorough removal of the pericarp or outer layer of the rice, only ineffectually accomplished by the native hand-mills, and that for gustatory reasons, there was removed at the same time some substance of vital importance to the economy. The next step of course was to feed the removed bran to those affected, and the result naturally confirmed what had been previously only a suspicion. This was followed by experiments upon animals, and the missing link in the chain of evidence was finally and firmly applied. It is of further interest to note, and especially perhaps to those with socialistic leaning, that the owners of rice polishing

mills found that the bran possessed a food value of a very high order for cattle, and commanded a high market price. This country, be it noted, was the first to take cognizance of these findings, and to pass a law forbidding the sale of completely polished rice in the Philippines.

These facts established, it soon became known that there were other members of a group of substances now called vitamins, having in common a complex structure, nitrogenous, crystalline bodies apparently belonging to a new chemical group, and separable from the parent substances by appropriate precipitants. They are absolutely essential to life, are necessary only in small amounts, but may be given in large quantities without harm. It is also known that originally our store of vitamins is drawn from the vegetable kingdom. We know now that in the animal kingdom, certainly, an absence of vitamins in the diet means death, and a deficiency means more or less departure from health. Besides true beriberi of the human we have the experimental type in birds, called *polyneuritis gallinarum.*

Scurvy and its close congener in children, Barlow's disease or Barlow-Cheadle disease, also experimental scurvy and pellagra (?), probably too rickets, osteomalacia, infantile spasmophilia, tropical endemic neuritis and sprue belong here. Manifestly various grades of symptoms may be present, some difficult of recognition, and then only when occurring in groups or when the character of food intake has been carefully investigated. On the other hand, such diseases as beriberi and scurvy, when at all marked, are simple to diagnose. When a limited diet has been taken uninterruptedly for weeks or months, a diet, for instance, consisting of white bread, flour, white rice, maize and cooked milk, the symptoms are many and variable, but for reasons now obvious, their nature should be suspected. Among these perhaps multiple neuritis deserves the first place. The extent and distribution vary widely, and the paralytic type may dominate, or in other cases, spasmophilia and contractures. Other cases present a cardiac complex. Bradycardia is often an early symptom. The right side of the heart dilates, with dyspnœa, cyanosis, diminution of urine volume, anasarca, hydrothorax, ascites and hydropericardium. These phenomena may occur in isolated, sporadic cases, but they are common in the well-developed case of beriberi. Then too the known, multiple hemorrhagic manifestations of scurvy, the swollen and bleeding gums,

extravasations into and under the skin, into the muscles, beneath the periosteum and serous membranes and the joint phenomena. Pellagra is diagnosed with its lesions in stomach and bowel, skin erythema and involvement of the central nervous system. Histories of war and pestilence, from remote times, cite instances of hunger œdema, and occasional outbreaks have occurred in institutions and gaols. Sydenham, the father of medicine in England, makes reference to it. Finally, xerophthalmia, failing vision with ultimate destruction of the eyes, has been traced to a lack of fat soluble vitamins.

Foods in relation to lower animal life have a humane, economic and scientific interest. Steenbock and his co-workers have shown that cattle fed on roughage may develop osteomalacia, and that in such instances the food has been found to contain an excess of magnesium salts which act as decalcifiers. This I quote from memory, not being able to recall the original reference. It is of importance, however, for confirmation should make us wary in ordering milk of magnesia, an especial common practice among pediatricians. It has been previously stated, that as a general rule, children are more susceptible than those of full growth to the milder types of avitaminosis and to errors in feeding in general. Another topic of most suggestive interest and value, I quote at some length from the article by G. Ennis Smith which was published in *Endocrinology,* July to September, 1919, page 262. This topic is introduced in order to accentuate the importance of a study of foods in general, for it is not known to have any association with vitamins in any direct sense.

" The author has described a thyroid disturbance that is prevalent among new-born domestic animals in western sections of this continent. The disease is one which affects swine, sheep, cattle, horses, goats and dogs, and occurs among such a wide range of animals that it appears very probable that if human beings were subjected to the same relative conditions, a more or less severe form of a similar thyroid disturbance would result. A profound influence of pregnancy upon the maternal thyroid, which may develop into a pathologic condition, has to some extent been recognized, but the attention has been confined mainly to the maternal organism. The manifestations of the thyroid disturbance among domestic animals show very clearly, however, that the effects are more disastrous to the fœtus than to the

maternal organism. It is our opinion that when this subject has been thoroughly explored, many of the cases of infantile fatality and of arrested development of children which are now vaguely designated as congenital, will be found to arise from a lack of function of the fœtal thyroid which may be overcome by a proper diet and conduct of the mother during the gestation period."

It is of special interest to note that this malady is largely endemic and corresponds more or less closely in geographic distribution to those areas in which goitre is commonly found. Many of the young are still-born and few live more than two days. The importance of this subject is best illustrated by the fact that the loss in Montana alone has amounted to about one million young pigs annually, and as previously stated, it is by no means confined to hogs. Symptomatically the condition resembles myxœdema or cachexia strumipriva. The iodine content of the thyroid is low. The gland is hypertrophied, interesting in connection with the view of Hector MacKenzie that the gland undergoes hypertrophy in non-toxic goitre, in an attempt to furnish more secretion. The evidence thus far favors the opinion that the disease is due to some deficiency of nutrition, "possibly an uneconomic use of available iodine." Hart and Steenbock have been able to produce hairless pigs presenting a symptom complex quite like those, the victims of this athyrosis, by feeding pregnant sows a high protein diet, and were able to obviate it by iodine feeding. Though the pregnant sow shows little evidence of any ill effect, there is some degree of maternal athyrosis, but the most malign influence is manifested in each succeeding litter. Even more important and more definitely related to these unknown substances, which at present we call vitamins, was the experimental work of McCollum with young heifer calves. Three groups were fed in rations as similar as chemical analysis was able to determine, differing only in their source. Group 1 was fed on corn, group 2, on oats, and group 3, on wheat. Each group was given the same amount of protein, carbohydrate, fat and salt. It required about a year before distinct differences were observed in the different groups. At that time the corn-fed animals were normal and their procreative functions were unaffected. The oat-fed animals were less sleek than the corn-fed, and their young, born fully two weeks before time, were still-born or died soon after

birth. Only one was saved by special measures. The wheat-fed were spare, rough coated, undersized, gave birth three to five weeks before term, and all the young died a few hours after birth, all being much underweight. Kept on the same diet, similar results ensued at the end of another year. Milk production for the first period amounted to an average of 24 pounds per day for the corn-fed, 19 pounds per day for the oat-fed, and eight pounds per day for the wheat-fed. These amounts during the second period of lactation were increased, averaging 28, 30 and 16 pounds, respectively. This is not unusual in the experimental animals and even in the human, the mother suffering in direct proportion to volume and quality of milk produced.

Other experimental evidence, far too vast to be detailed in a brief paper of this character, has served to show the presence in certain foods of some substances vitally necessary to reproduction, to growth and to nutrition. Pure food mixtures containing all the primary food substances and necessary salts, not only failed to maintain growth and nutrition, but in different animals, produced different symptom complexes. The earliest work was that of Eijkman, a Dutch chemist, who in 1897, first produced polyneuritis in birds by feeding them with polished rice. He found two or three weeks of such feeding sufficed to produce the disease, and that the addition of small amounts of the rice polishings sufficed to cure it. Curiously, he failed to grasp the full significance of his work, as did our American investigators, the Philippine Commission, whose work covered a period of over ten years, from 1900 to 1911. It was in 1906 that Hopkins, an Englishman, first called attention to hypothetical food substances which he called "accessory food factors." In 1907 Fraser and Stanton, two Englishmen, were the first to find that curative virtue existed in the alcohol precipitate of rice polishings. In course of time it came to be shown that three and possibly four groups exist. McCollum has termed them fat soluble A, water soluble B and C, and more recently Hess has suggested the possibility of a D vitamin which may be antirachitic.

Mellanby, an Englishman, contends that the A or fat soluble vitamin has antirachitic properties. This view, however, it not generally accepted by the American group of nutrition experts. Mellanby studied a number of fatty substances, notably cod-liver oil, butter fat,

bacon fat, lard, suet and many vegetable oils. He also showed that cod-liver oil far exceeds all other fats in its antirachitic properties, but showed too that suet and butter fat both exercise an important influence on calcification. The vegetable fats and oils vary in antirachitic properties, many wholly lacking them, and even the more favorable ones possessing rather a small value. Mellanby also confirms the finding that by heat and oxidation of a fat, much of its antirachitic property is lost. To Hopkins belongs the credit of first demonstrating that oxidation destroys fat soluble A vitamin. Fat so treated loses the growth factor and the property of curing xerophthalmia, due to the absence of the fat soluble A from the diet.

In their latest paper on this subject, McCollum, Simmonds, Becker and Shipley in the *Journal of Biological Chemistry* (Vol. liii, August, 1922, p. 293), in a paper entitled, "Studies on Experimental Rickets," have shown, first that cod-liver oil, when oxidized for 12 to 20 hours, does not cure experimentally induced xerophthalmia. It is still able, however, to cause the deposition of calcium in the bones of young rachitic rats. Hence oxidation destroys fat soluble A without destroying some factor which has the property of stimulating calcium deposition—bone growth and repair. Butter fat also possesses the property of depositing calcium, but to a much smaller degree than the fish oils. Mellanby showed also that cocoanut oil possesses antirachitic properties, but not the anti-proophthalmic. Hence it has been demonstrated that the best of all fatty substances is cod-liver oil and some other fish oils, and that these possess preventive and curative properties against xerophthalmia, protecting against a deficiency of calcium and bringing about a deposition of calcium salts in rickets. It has also been shown that the antirachitic property is not due to the presence of fat soluble A. Thus the proof of a fourth vitamin which seems to be able to regulate bone metabolism. In the same Journal of August, 1922, McCollum, Simmonds and Becker report another and less serious form of ophthalmia occurring in rats, due to a dietetic error, not lacking, however, in fat soluble A. They do not feel that they have definitely established its etiology, but tentatively ascribe it to a diet high in chlorine, possibly high in sodium, while perhaps other inorganic salts may contribute.

Whatever may be the ultimate view as to the water soluble substances, butter fat, which carries the "A" vitamin, is both nitrogen and phosphorous free. It seems scarcely justifiable, therefore, to call this growth and nutrition factor a vitamin, yet custom has come to sanction it.

Animals do not synthesize vitamins, but obtain them directly from food eaten. It is obvious, therefore, as far as milk is concerned and also the flesh of cattle, it is of vital importance to the welfare of the growing child especially that careful supervision should be given to the food substances of these animals. Fortunately for the adult human, nature has been lavish in the distribution of the vitamins thus far recognized as such. The table of the British Research Committee gives the present knowledge concerning the vitamin content of foods. This was published some weeks ago in the *Journal of the American Medical Association.* It is too lengthy to give in full, but briefly, the "A" or fat soluble vitamin is found in butter, milk, egg yolk, carrots, spinach, lettuce, cabbage and the germ of cereals. A moderate amount is present in meat. The modern milling processes have deprived our grain foods of much of their essential food value, and it is appropriate here to call attention to the value of the unrobbed cereals as a food. This type is not affected by the usual methods employed in cooking. So too with the " B " or water soluble vitamin, unless boiling is continued over a long period or a temperature above boiling is employed. Greater harm follows if the boiling medium is distinctly alkaline, a fact worthy of note in connection with the practice of adding an alkali, such as bicarbonate of sodium, to the water. Milk and, in greater amount, eggs furnish the " B " type, also condensed milk, cheese, most of the nuts, some of which contain "A" vitamin also, as the peanut, almond, cocoanut and hickory. The flesh of animals contains very little of the water soluble " B," but the brain, liver, kidneys and particularly the pancreas, all contain it. Carrots, cabbage, cauliflower and celery in abundance, likewise onions, parsnips and potatoes. Spinach is rich in both "A" and " B," and the added value of the vegetables is that most of them contain a large amount of antiscorbutic properties. This is also true of most of the fruits. In beans and peas the vitamin is found throughout their substance, but in grains it is practically confined to the embryo. Yeast is rich in water

soluble "B" vitamin, it lacks both the "A" and "C" type. It is probable that it serves to stimulate the appetite. But Rabelais probably hit the nail on the head when he said "The appetite comes with eating." So too said Shakespeare, "Good digestion waits on appetite, and health on both." It is even more likely that the use of "B" vitamin foods would serve infinitely better than yeast to awake a desire for food. It is surprising how many people confine their diet to relatively few articles of food, and despite the so-called "tonics," continue to take insufficient nourishment, in my opinion, chiefly because they lack the necessary variety and the stimulus to appetite which I believe is given by water soluble vitamins. That appetite really does come with eating is not sufficiently recognized. I cannot feel that medicinal tonics are necessary. The water soluble "C" vitamin, antiscorbutic, is very readily destroyed by heat, drying and alkalies. This is found especially in oranges, lemons and grape fruit, less in limes, with which apples and pears are classed, but in large amount in cabbage, turnips, tomatoes, lettuce and watercress.

At present it is a matter of some difficulty to adjust diets with any sense of conviction in cases of nutritional disturbances, whether in the stage of growth or in later life. So many factors have to be dealt with, over some of which, as individuals at least, we have no control. Indeed, it is a question whether the pure food law has been an unmixed blessing. Possibly our legal representatives at Washington may decide these questions for us, as they have done in the case of alcohol, narcotics, and in the revision of the Pharmacopœia!

In the choice of food for the average adult, enough is now known to make certain the statement that the mere presence of proteins, carbohydrate and fat will not necessarily suffice even when in correct proportions. Certain it is that accessory food factors are necessary. This is of special importance in the case of the nursing mother, and just as important in cattle, since milk is the staple food of the infant. Vitamins, not being synthesized, can only be gathered from food intake. The diet, especially that of nursing mothers, should therefore contain a variety of the green vegetables especially, despite the common prejudice. The French empirically have long known what they are doing when they put the water in which fresh vegetables have been boiled into their soups. In addition, of course, both "A" and

"C" vitamins are necessary, but appetite will usually increase under the stimulus of "B" vitamins. Hand-reared babies are safe on pasteurized milk as far as "A" and "B" vitamins are concerned, but the sensitiveness of "C" vitamins to heat and alkalies should suggest the addition of orange juice or even tomato juice to their diet, for that is well borne. Spinach, which contains a large amount of "A," "B" and "C" vitamins, is not only an excellent food for adults, whether nursing mother or not, but the expressed juice is decidedly advantageous for nursing children, and especially for bottle-fed babies. Both adults and children should be systematically weighed and a record kept. Cod-liver oil, rich in "A" vitamin, is now regarded as the best remedy in rachitic children. Whether as Mellanby believes, its virtue is due thereto, or whether it possesses another factor, tentatively referred to as "D" vitamin is still in doubt. (The contribution of McCollum and his co-workers, quoted above, added since this paper was written, has apparently settled this point.) It is said too that it possesses the property of fixing calcium salts. Schmorl has called attention to the seasonal development of rickets, being more frequent in winter than in summer. This is of interest in connection with the recent claim of Hess that the disease is favorably influenced by sunlight and also by the ultra-violet ray.

It is still a question as to whether pellagra can be classed with the avitaminoses, though there is considerable suggestive evidence that it depends upon some food factor, as yet unknown. Time does not permit the inclusion of many interesting experimental contributions to this subject. Suffice it to say that rats are not subject to scurvy while guinea-pigs are. In a recent number of the *Journal of Biologic Chemistry,* Shipley, McCollum and Simmonds report that rats fed on a complete diet but for the absence of the antineuritic, water soluble "B," develop bone changes exactly like those in guinea-pigs fed on a complete diet lacking only the antiscorbutic factor. On a diet lacking in "A" vitamin, their bones become osteoporotic. Clinically, too, in the human, beriberi and scurvy have several lesions in common. The lesson to be deduced is that one should not place reliance on a single food factor, basic or accessory, but should endeavor to utilize a complete food in every sense in dealing with depraved nutritional states.

In closing I quote from an article in the *Scientific Monthly* for October, 1919, by Prof. I. Newton Kugelmass, head of the Department of Chemistry, Howard College.

"Educational reforms will bring the science of nutrition from the theoretical background to the practical front. For that indispensable service we need universal instruction in nutrition, dietetics, prophylaxis, child health; competent, trained, elementary school teachers, and health visitors in nutrition and public health; infant welfare centres; social service staffs; more social unit organization work under the auspices of the child welfare leagues and child health associations; public coöperative kitchens; public demonstration centres; public school child feeding; regular and periodic inspection of school children; more financial aid to mothers; more housekeepers' clubs; more public lectures on health, nutrition and sanitation. The public cannot go to the schools; we must go to the public."

THE FRENCH AND AMERICAN CONCEPTIONS OF ACIDOSIS

By MARCEL LABBÉ, M.D.,

Professor of General Pathology at the Faculty of Medicine of Paris; Physician to the Charité Hospital, etc.

AND

HENRY BITH, M.D.,

Assistant Physician to the Charité Hospital, Paris, France

The term *acidosis* was employed for the first time by Naunyn, and afterwards by Walter and Stadelmann, to designate the appearance of incompletely oxidized acid substances in the organism of diabetic subjects, which produce an intoxication of the patient. All vital acts occur in an alkaline midst, hence if the alkalinity decreases, disturbances ensue.

The agents of acidosis are the acetone compounds—acetone, diacetic acid, β-oxybutyric acid—and probably also oxalic, butyric, valerianic, propionic, crotonic, capric acids, etc.

Diabetic acidosis, to which the entire group of non-diabetic acidoses has been added, has for a long time been classic, and its clinical signs and laboratory technics, which characterize it, are known to all.

On the other hand, its mechanism and the means employed by the organism to oppose it are much less clear and are the object at present of much discussion.

The acetone compounds are derived from fats and albumins, but in the normal state they are destroyed in the body by oxidation. It is the absence of destruction that creates the pathologic state. According to many observers the carbohydrates are necessary for combustion of fats, hence it is that for them acidosis is produced when the carbohydrates are introduced in the food in insufficient amount or when the organism cannot utilize them, as in the case of diabetes.

Besides the acid toxicity of the acetone compounds it has been shown that a part must be given to a special toxicity probably belonging to each of these various compounds. If acids with an alcohol

function—lactic and β-oxybutyric acids—are saturated, they remain highly toxic as proved by the researches of M. Labbé and Violle, as well as by Professor Lépine, of Lyons.

Hugounenecq, Roque and Devic have likewise shown that by bringing back the blood serum of a comatous diebetic patient to normal alkalinity by the exhibition of sodium bicarbonate—the serum being highly acid and hypertoxic—the toxicity of the serum is decreased 66 per cent., but it nevertheless remains far more toxic than normal serum.

Now this is because, besides acid toxicity and the special toxicity belonging to the acetone compounds, there is still another cause of toxicity, namely, that due to nitrogenous substances derived from an exaggerated and abnormal metabolism of protein matter. Hugounenecq and Morel have demonstrated this fact and we, as well as Henri Labbé, have shown that it assumed great importance in the organism of diabetic subjects with denutrition. In them there is hyperaminoaciduria, an increase of collodial nitrogen and residual nitrogen of the blood serum.

Then Marcel Labbé and his co-workers, Le Lorier, Marfan and Comby, showed that the acidosis syndrome can be encountered in other morbid processes besides diabetes, such as dyspeptic coma, acetonæmic vomiting in children, pernicious vomiting of pregnancy, as well as in numerous abdominal affections, and that in these circumstances there is not only intoxication from the acetone compounds, but also an intoxication due to an abnormal metabolism of albumins.

After this we showed the relationship existing between the acidosis and hepatic insufficiency, either because of a gross pathologic process in the liver or some functional disturbance of the organ.

Therefore the acidosis appeared a physio-pathological and clinical individuality until the researches of Henderson, Van Slyke and Hasselbach enlarged the conception and offered a much more vast definition.

It is known that the concentration of the tissue fluids by the ion H is constant. The variations produced by the introduction or production of new acids are counterbalanced by the presence of sodium bicarbonate and the acid phosphate of sodium. For example, the bicarbonate decomposes, liberating carbonic acid which is eliminated

and by its bases it attenuates the effect produced by the addition of the acid on the concentration of the ion H. These substances—bicarbonate and phosphate—are called "tampon substances." Therefore, in every organism there is an alkaline reserve which can be liberated by a physico-chemical process.

Thus the organism defends itself against the increase of acids by taking to itself the sodium of the bicarbonate which it decomposes; it rids itself of the carbonic acid resulting from this splitting up and eliminates it by the lungs in the gaseous state, while the non-volatile acids are eliminated by the kidneys and the phosphoric acid by the intestine.

As soon as the concentration of the ion H tends to increase, the respiratory centres—which are remarkably sensitive—activate the ventilation in order to diminish the tenor of CO_2 in the blood until the coefficient $\frac{CO_3\,H_2}{CO_3\,HNa_2}$ returns to normal. This coefficient which remains constant is $\frac{1}{20}$. If the bicarbonate diminishes for neutralizing the acidosis, an equal proportion of CO_2 should be eliminated. It is sufficient to measure the amount of CO_2 eliminated by the air in the pulmonary alveolæ in order to estimate the CO_2 in the blood, which is equal to it, and as the coefficient $\frac{CO_3\,H_2}{CO_3\,HNa_2}$ remains constant, it is easy to estimate the amount of bicarbonate in the blood.

Thus, as Van Slyke has shown, the amount of bicarbonate should be the criterion of the proportion of acids and bases contained in the blood. It represents the excess of bases which remains after all the fixed acids have been neutralized; it is the base which is disposable for the neutralization of any excess of acids as soon as they appear and this is what has been termed the "alkaline reserve." The true definition of acidosis, according to Van Slyke, is the state in which the concentration of sodium bicarbonate in the blood is reduced below the norm.

Consequently for these observers, the diagnosis of acidosis is to be made by the dosage of the sodium bicarbonate in the blood, the dosage of CO_2 in the blood and lastly the dosage of the expired CO_2. In practice the latter dosage in sufficient, because the percentage of CO_2 in the pulmonary alveolæ is very exactly equal to the free CO_2 in the blood, and from the percentage of CO_2 in the blood one can

deduct the amount of sodium bicarbonate, because the coeffcient $\frac{CO_3H_2}{CO_3HNa_2}$ is $\frac{1}{20}$.

Thus understood, for Anglo-American observers acidosis is due to an incomplete combustion from want of oxygen or to a superproduction of acid or to renal impermeability, the kidneys being powerless to eliminate acids produced in normal or abnormal quantities. Consequently the pathological conditions in which one encounters this acidosis are much more frequent than those in which acidosis is present according to the conception of the French school.

Under a first heading the American school includes acidosis due to imperfect oxygenation, such as occurs after violent excerise, mountain sickness, the acute anæmias, gas poisoning, in asphyxia, asystolia and in pregnancy.

Under a second heading the American school comprises acidosis dependent upon renal impermeability, preventing the elimination of acids, such as is met with in the nephritides and frequently in the anti-mortem phase of numerous diseases.

Finally, under a third heading is placed acidosis related to the overproduction or to the absence of destruction of abnormal acids that are met with in diabetes, inanition, intoxication by anæsthetics and the cyclical vomiting of childhood. The latter cases alone correspond with the French conception of acidosis, and some observers, Allen in particular, have proposed separating them from all other acidoses under the name of " ketosis."

We likewise believe that this group of cases should be kept apart from the other types because by itself in the midst of acidosis as understood by the American school, it possesses a clinical, pathogenic and therapeutic individuality. One should also retain its initial name of acidosis which had always been given it by European observers, because the same word when applied to the enlarged conception at present results in a confusion which we are continually perceiving.

For that matter, ketosis may not necessarily be accompanied by acidosis in the strict sense of the word. Thus Van Slyke and Cullen have reported the case of a patient who excreted 20 grams of acetone compounds in the twenty-four hour urine, although there was no decrease of the alkaline reserve.

According to our way of thinking, acidosis forms a well-defined

syndrome from the clinical standpoint, in which some symptoms are to be found, some constantly, others very frequently.

The most frequent symptoms are slight but constant headache; an epigastralgia, often most distressing in type; asthenia; torpor with more or less marked somnolence which may even reach coma. Mental disturbances are not infrequent.

Dyspnœa, assuming more or less exactly the type described by Küssmaul, is all the more marked the more serious the case. Digestive disturbances are frequent. In the first place there is a mild stomatitis, but constant, with a red, varnished tongue, anorexia always marked, sometimes diarrhœa and usually repeated vomiting which may at length assume the pernicious type.

The constant stigmata of acidosis are on the one hand, the odor of the breath, on the other, the urinary and blood changes.

The odor of the breath recalls that of a russet apple or chloroform and in the majority of cases is the first sign which calls attention to the patient's condition. The urine—which is very acid—may give off a similar odor; usually it is voided in large amount and is clear. The presence of acetone is detected by Lieben's reaction and diacetic acid by either Legal's or Gerhardt's reactions. The total acetone compounds are to be estimated by Van Slyke's method.

It is also possible to detect the acetone compounds in the blood serum and cerebrospinal fluid.

And what is more, one can always demonstrate the signs of hepatic proteolytic insufficiency by examination of the urine and blood serum, made evident by an increase of ammonia, amino-acids and colloidal N in the urine, an increase of the coefficient of ureogenic imperfection and a decrease of the azoturic coefficient. In the blood there is an increase of the residual N and N titrable by formol. Lastly, when the acidosis is diabetic there is glycosuria and hyperglycæmia.

It is quite useless to repeat that in this acidosic syndrome one usually finds signs of acidosis according to the enlarged conception given to the term by American observers, namely, a decrease of sodium bicarbonate and CO_2 in the blood estimated by Van Slyke's technic and a diminution of the pulmonary CO_2 estimated by Haldane's or Frédericia's technics, which indicates that there is a decrease of the alkaline reserve of the blood.

According to their grouping, the signs of acidosis give rise to varied clinical types, among the most frequent of which are the somnolent, comatose, dyspnœic, delirious and emetic. Finally, there are the latent cases which can only be detected by a minute examination of the patient, including a complete analysis of the urine.

The syndrome of acidosis is above all encountered in diabetes, especially the type of the disease with its denutrition. As this is common knowledge further remarks are unnecessary. Other morbid processes in which this syndrome is frequently present are: The cyclical vomiting of childhood in which it constitutes a well-known clinical syndrome; in the serious types of digestive diseases, such as ulcer or cancer of the stomach or intestines; serious types of appendicitis and dysentery. The syndrome may result in death, in which case the term of dyspeptic coma or cancerous coma has been given.

During the evolution of hepatic processes, the syndrome of acidosis often develops at the terminal phase of cirrhosis, in abscesses of the liver, in the cholecystitides, because as has been said, acidosis appears to be due to an insufficiency of the liver. This fact also explains the acidosis in affections of the digestive organs, infections of the genital organs, uterus and ovaries, because all these viscera are directly or indirectly tributary to the portal vein. Hepatic insufficiency likewise explains the accidents arising after narcosis with chloroform or ether, and lastly, it is also probably the reason for the acidosis so frequent during gestation and which seems to play a part in the pernicious vomiting of pregnancy.

As to the acidosis of fasting it generally does not assume the classic form of the syndrome that we have described and is only made evident by urinary stigmata. And in point of fact, it only develops very slowly, always remains moderate and does not bring about the serious consequences of the other acidoses. It is not constant and may be absent in prolonged inanition. Thus in a case of absolute fasting during a tabetic gastric crisis, on the eleventh day Gerhardt's reaction in the urine was negative. If an acidosis from fasting really exists it has not the same pathogenesis nor signification as the pathologic acidoses. Thus, when a patient with diabetes without denutrition or acidosis is made to fast, Gerhardt's or Legal's reaction will appear in the urine about the third day although there is no

clinical evidence of acidosis, and here we have a veritable acidosis from fasting. If on the contrary a diabetic with denutrition and acidosis is made to fast the urinary stigmata will decrease or sometimes even disappear at the same time as the more or less serious clinical manifestations of acid intoxication. In these circumstances fasting caused the pathologic acidosis to disappear. Therefore there is an absolute difference between the acidosis of fasting and pathological acidosis.

The syndrome of acidosis, as we understand it, always has a serious prognosis, not so much *quoad vitam,* but because it indicates a profound involvement of the liver or the gravity of the type of diabetes.

When acidosis is present, treatment is urgently required. If the patient is diabetic in serious cases he should be made to fast as indicated by Guelpa, and later by Allen and afterwards submitted to a diet from which albumin and fats are to be eliminated as far as possible. A green vegetable diet fulfils these desiderata the best of all. In certain cases an oatmeal cure according to Von Noorden or Labbé's vegetable cure will give excellent results.

The value of administering sodium bicarbonate with the intent to increase the alkaline reserve and to facilitate the neutralization of the acids has recently been disputed. If used the bicarbonate may be given by mouth, rectum or intravenously, according to the gravity and urgency of the case.

If the patient is not diabetic, it is proper to give a diet rich in carbohydrates and poor in fats and especially in animal albumin. Sodium bicarbonate may also be prescribed in these cases.

Acidosis, in our conception, is a syndrome which we think should be individualized clinically, pathologically and therapeutically. On the other hand, the American conception, which offers a great pathogenetic interest, does not present a clinical entity. Hence we believe that the term *acidosis* should be applied to the syndrome of intoxication from acetone compounds, and that the syndrome due to a decrease of the alkaline reserve of the blood should be termed *basal hypoalkalinity.*

ALBUMIN MILK IN NUTRITIONAL DISORDERS OF ARTIFICIALLY FED INFANTS *

By AUGUST STRAUCH, M.D.

Attending Physician at the Cook County Hospital, Children's Department; Instructor in Medicine (Pædiatrics) Rush Medical College; Attending Physician at the Central Free Dispensary, Children's Department, Chicago

THEORETICAL AND CLINICAL BASIS OF ALBUMIN MILK

The administration of albumin or protein milk, successfully introduced to pædiatricians by Finkelstein and Meyer, is based upon the modern conception that excessive endogenic bacterial fermentation is the principal pathogenic factor in the production of most of the diarrhœas of children. It is especially the abnormal fermentation of the carbohydrates that leads to the development of low fatty acids which act as intestinal irritants, while those acids derived from fat that is given ordinarily in moderate quantities are principally secondary to the former pathologic process.

The former doctrine that attributed the difficult digestibility of cow's milk and the formation of "obnoxious residues" within the intestines, principally to casein, had to be abandoned. In the light of evidences obtained through the therapy of intestinal fermentations by the use of casein the latter acts as an antifermentative and antidiarrhœic. This action is due to its stimulating the secretions of the intestinal juices in the presence of calcium, causing conditions favorable for the production of alkaline firm stools. An appropriately increased percentage of casein by this antagonism to obnoxious fermentation and by some other factors indeed increases the alimentary tolerance for carbohydrates as also for fat. Exceptionally, casein may prove adverse, causing vomiting and other digestive disturbances; for instance, if the coagula are too firm and coarse.

The digestion of carbohydrates depends not only, as a matter of course, on the functional capacity, *i.e.*, the tolerance of the digestive organs, but to a great extent on the variety of the carbohydrate administered. The physically different kinds manifest differences in the

* Clinical lecture delivered at the Cook County Hospital, Chicago.

fermentability, the limit of assimilation, in the metabolic processes and the effect upon the apposition of tissue and water, the importance of which becomes evident especially in disease. As a matter of fact, the aprioristic idea of the physiologic milk sugar being the most suitable addition to artificial food had to be abandoned as the result of experiment and clinical experience. Milk sugar is a very active promoter of the growth of acid forming bacterial flora; its great fermentability and slow resorption is more likely to provoke dyspeptic stools than some of the other carbohydrates, including beet (or cane) sugar, which ranks second as to fermentability; the other members of the group, namely the dextrine-maltose mixtures and the various kinds of flour, unless administered in excessive amounts, being much less subject to abnormal decompositions within the intestinal tract. The same holds true of their pyretogenic and toxic effects. A lesser degree of fermentability generally will decide the choice of a particular carbohydrate in the ordinary milk mixtures with labil digestive organs. It is noteworthy that the combination of two or three varieties of carbohydrates, including a polysaccharide is far superior to any single member of the group. That the tolerance of fat is augmented by the use of the better borne carbohydrates, has been demonstrated by Helbig and others.

Investigations upon the rôle that cow's milk whey plays in pathologic fermentations, revealed that it promotes the latter to a greater or less degree depending on its concentration. A given quantity of sugar in undiluted whey leads more likely to dyspeptic disturbances than the same quantity in diluted whey or water. Milk mixtures with abundant amount of whey more often lead to diarrhœas or alimentary fever than mixtures with reduced quantities of whey, *ceteris paribus*. Dilution or quantitative reduction lessens the fermentation and simultaneously increases the toleration for carbohydrates and fat. Also casein to a certain degree is antagonistic to the action of whey. Thus it would be a great mistake to consider each of the milk constituents without the correlation, namely the percentage relation of the various ingredients of the milk to each other (Langstein).

THERAPEUTIC MEASURES IN FERMENTATION DIARRHŒA

Utilizing these well-established facts of nutritional therapy in combating pathologic fermentation, one may avail himself of several methods. For instance, a temporary radical diminution of the amount of carbohydrate; this plan, however, must prove disastrous, if unduly prolonged, on account of the indispensableness of the carbohydrates, especially in infants affected by the more severe nutritional disorders. Likewise a *prolonged* milk-free diet in a dyspeptic infant such as an exclusive flour decoction feeding is unconditionally objectionable on account of its causing a qualitative inanition. Milk must soon be given, though in reduced quantities. On the other hand the substitution of the readily fermentable milk or beet sugar in the milk mixture by flours, finest cream of wheat and dextrinized flours, or especially by the dextrine-maltose mixtures, proves very advantageous to such a degree that their use is at the present time universally advocated.

Utilizing the antifermentative property of proteins we may add to the milk mixtures certain commercial preparations of calcium caseinate. These mixtures resemble, but are not identical with, the albumin milk of Finkelstein. It is not amiss here to mention that especially in the dyspepsia of breast-fed infants affected with the neuropathic diathesis, the administration of ten to fifteen grams of protein powder per day, suspended in sweetened water or alkaline mineral water—a level teaspoonful of the powder in an ounce of the medium two to three times a day before nursing give excellent results, through the mode of action is not definitely established (Raczynski, W. Freund, Finkelstein). The lessening of peristalsis, the disappearance of colics and diarrhœa, the quieting of the baby and the general improvement are not infrequently actually surprising.

Another method to combat fermentative diarrhœas in the bottle-fed is to avail ourselves of a kind of milk with an original high percentage of finely distributed casein, such as buttermilk; or the preparation introduced by Finkelstein and Meyer and its subsequent modifications by various authors. In butter-milk, as well as in Finkelstein's *Eiweiss* or albumin milk, the obnoxious milk sugar is diminished, in the latter also the whey, whereas both its casein and

calcium content have been augmented in correlation. In both kinds the acidity aids the digestive function. The deficiency in carbohydrates naturally has to be made up by the indicated quantity of the less fermentable members of the group or their combinations (even cane sugar in combination with flour).

PREPARATION OF ALBUMIN MILK

The preparation of Finkelstein's albumin milk is as follows: Rennet or essence of pepsin or a similar preparation is added to one litre (quart) of raw milk which at the temperature of 42°C. (107.6° F.) is precipitated within one-half hour. After rapidly cooling the mass is placed in a piece of cheesecloth in an ice box, and the whey is allowed to drain off without pressing for about an hour. The casein curd then is very finely distributed by gently stroking it through a fine hair sieve by means of the bowl of a spoon. This process is repeated several times and aided by the addition of one-half litre (one pint) of water. Finally one-half litre (one pint) of butter-milk is added, and the whole mixture sterilized by cooking. Clumping in large masses is prevented by stirring it vigorously and continuously during the heating. The product contains approximately: 3 per cent. protein, 2.2-2.5 per cent. fat, 1.4 per cent. milk sugar, 0.5 per cent whey salts and some lactic acid. It represents about 400 calories per litre.

USE OF THE PREPARATIONS ON THE MARKET

On account of the close attention to details and the skill necessary to meet technical difficulties in the proper preparation of albumin milk, especially a very fine subdivision of the casein into minute soft floccules being essential for its full therapeutic success, the use of protein milk has been mostly confined to institutions. However, various commercial preparations, ready or practically ready for use, of a stable and uniform composition in concentrated liquid or powder form have facilitated its introduction by the general practitioner into private practice. The powder, of course, has to be brought into suspension or emulsion by mixing it with water. In the process of manufacturing the powder, the milk mixture in the dessication spray chamber is subjected to only moderate temperatures for an instant

whereby the accessory substances, the vitamins, are preserved. For sweetening, if necessary, saccharine may be used and carbohydrates added in amounts to be discussed later.

INDICATION FOR THE USE OF ALBUMIN MILK

While in the minor disturbances, the pathologic fermentation within the intestinal tract may be arrested by the ordinary methods, as by a temporary reduction of the carbohydrates or of the total amount of the food, with the elimination and correction of some gross error in feeding, in the more severe forms of acute or chronic character these measures too often fail to accomplish the desired result. It is in such instances that butter-milk and especially the protein milk, by shifting the correlations, will, as a rule, more readily than any other dietotherapeutic measure so far known bring about the improvement and restoration to the normal, after a strikingly rapid disappearance of fermentation. The principal field for the use of protein milk is in the fermentation diarrhœas of alimentary origin; the acute dyspepsia, including the forms with severe intoxication (cholera infantum, enterocatarrh, acute alimentary intoxication); chronic dyspepsia (dyspeptic form of dystrophy) and its consequences; and the atrophy (pædatrophy, alimentary decomposition). The broader scope of albumin milk as a therapeutic food comprises flour dystrophy (*Mehlnährschaden,* Czerny, Keller); the parenteral and enteral infections (bacterial enteritis); the intestinal disorders during weaning of the infant from breast to cow's milk (ablactation diarrhœas); its use as a prophylactic food in the complimentary feeding of very young breast-fed infants (Sauer); and in diarrhœa of breast-fed children, based on the neuropathic diathesis.

We have it in our hands to vary the concentration, increasing the same above the standard to meet special indications, as for instance, in "simple dystrophy" (Finkelstein), in habitual vomiting of infants and especially in the "initial diarrhœa" (W. Freund, Davidsohn) observed frequently in infants soon after admission to a hospital. The addition of double concentrated protein milk with 15 to 20 per cent. carbohydrate to other food, for instance, one-half to two-thirds milk mixture or to standard protein milk, may be indicated in order to enrich the food without increasing its volume; thus

its nutritional value may be increased up to 130 to 150 calories per kilo body weight. In the "initial diarrhœas" the customary reduction of food by protracted inanition tends to aggravate the affection, whereas an increase of the food calories influences it favorably. The cause of the success of this procedure, recently adopted, seems to lie in the improvement of the cell function by an augmented food supply, adequate to the great nutritional requirement of such infants. Also anorexia, rendering impossible the ingestion of sufficient feeding quantities, so often met with, for example, in hospitalized infants, may indicate an increase of the number of caloric units by concentrating the food without increasing its volume. Water *ad libitum* should be given during the feeding intervals.

TECHNIC OF APPLICATION OF PROTEIN MILK IN DECOMPOSITION (PÆDATROPHY) AND CHRONIC DYSPEPSIA

Following Finkelstein's detailed advice one begins with short water or tea saccharine diet, lasting for six, or at the most, twelve hours, this being done with the object of ridding the intestinal tract of its obnoxious matter. This is followed with about 300 grams, or a larger quantity of protein milk in milder cases; to which has been added 3 per cent. to 5 per cent. of carbohydrates in five to six feedings per day; in severe forms the food is given in 8 to 10 portions. Additional tea or water must be given in the way of fluids. Without much atttention being payed to a possible continuation of the diarrhœa, this amount of protein milk is to be increased, say every second day by 50 to 100 grams, or more in the presence of improved stools, until 180 to 200 grams daily per kilo body weight are reached, the larger volume meeting the larger requirement of older atrophic infants. There is no need to exceed one litre (quart) as the daily maximum. If no increase in body weight occurs after a certain period of time, the carbohydrates should be gradually increased from 5 to 7 to 10 per cent. or more. In babies beyond the sixth month of age the usual by-food must eventually be administered. Among the carbohydrates the dextrine-maltose mixtures should be preferred though in milder cases frequently also the combination of cane or beet sugar with ½ per cent. to 2 per cent. of flour (flour ball) according to age may prove very satisfactory.

The great advantage of this food lies in the possibility of a sufficient quantitative increase more rapid than with any other milk mixture, without exciting a new fermentation; thereby the danger of the inanition period is reduced and the so-called reparation process accelerated. Even in severe disorders sufficient carbohydrates may be ingested in this medium, to meet the requirement without fear of a return of fermentation with retardation of the reconstruction, as the digestive tolerance for carbohydrates is considerably increased. It should not be denied that the factors dealt with in explaining the beneficial action of protein milk may not be the only ones, perhaps very complicated biologic processes in connection with the function of the body-cells playing a certain rôle.

RESULTING REPARATION

If one procedes in the above manner given in detail, failures are considerably less frequent than with any other method of artificial feeding. In the typical cases, which are in the great majority, a very striking improvement of the stools takes place by becoming dry, soapy and less frequent, as early as the third or fourth day, provided the diarrhœa is due to fermentation. Those diarrhœas—it is true—of infectious origin naturally improve more slowly, as the infection can be overcome only by the immunizing reactions of the body.

In the beginning a stage of aggravation is often noticed, due partly to the therapeutic underfeeding, the duration and degree of which under any consideration must be reduced to the lowest possible minimum, especially in atrophic babies. Starvation, be it only a partial one, as in carbohydrate deficiency, after a brief period may severely disturb the recuperative forces and to a still further degree the food tolerance, eventually to the degree of irreparability. This must be forestalled by a sufficiently rapid, though judicious increase of protein milk and carbohydrates as already outlined.

With the improvement of the stools, the loss in body weight and the dehydration are arrested, the tissues regaining their ability to store up and retain water—the physiologically fixed tissue water—and to regulate the osmosis, thus improving its turgor. The food tolerance grows, and the general state of the patient shows a betterment.

Finally, re-apposition of the tissue, lost by the alimentary disorders, takes place (stage of reparation, Keller). At first being slow the growth of body weight becomes as a rule more rapid, provided a sufficient supply of carbohydrates is added to the food mixture. Though the abnormal fermentations as a rule are soon reduced or entirely abolished the gastro-intestinal canal still betrays functional deficiency for a period; thus relapses must be guarded against.

DURATION OF ADMINISTRATION

Depending on the age, the individuality and state of the baby and the severity of the malady, the duration of the reparation period to full restoration and the establishment of normal food tolerance varies from about four (or less) to ten weeks. If after this time the transition to ordinary mixtures should cause a recurrence of the disorder the period of protein feeding should be instituted again and carried on for about three weeks. With a prolonged albumin milk diet antiscorbutic fruit juices should be given.

TECHNICAL MISTAKES

Failures in so far as they are not due to the irreparable state of the patient by an extinction of the assimilative cell function, or severe infections, or to an improper defective preparation, may be traced to three principal mistakes causing injury to the baby by inanition:

(1) Insufficient dosages of protein milk in the beginning of treatment.

(2) Too late addition or too small amounts of carbohydrate.

(3) Withdrawal of carbohydrate or excessive diminution of food during a recurrence of the symptoms of nutritional disturbance after a period of improvement.

Finkelstein and his co-workers warn emphatically against these "typical mistakes," likely to be made in instances where signs of a disturbance of the regenerative processes are present, where, for example, the frequent and thin stools should persist. Disappointing experiences in the beginning of the era of albumin milk therapy amply bore out the correctness of these statements.

No undue stress should be placed merely upon the pathologic

character of the stools as a guide for our dietary therapy. The persistence of abnormal stools under these conditions has its origin as a rule not primarily in abnormal fermentations within the intestines but rather in enteral or parenteral infections, especially in grippe. Such diarrhœas naturally do not respond promptly to merely dietary antifermentative measures, important as the latter are in our therapeutic plans. Notwithstanding these conditions the food supply must be gradually increased. Only severe signs, as a steep drop in body weight, acute toxic manifestations with infections or a progressive aggravation indicate a temporary reduction and subsequent gradual increase of the food amount. But "never resort to fatal deprivation of carbohydrates."

In some cases the stools improve later, when a sufficient quantity of carbohydrates are added to the full amount of albumin milk so as to cause an increase in body weight. It appears that underfeeding by itself, be it general or partial, whether consisting in deficiency of carbohydrates or alkalies in the food—instead of the more common "hunger constipation"—may occasionally cause diarrhœas in certain infants, especially the atrophic ones and those affected with constitutional hydrolability. These forms improve upon appropriate augmentation of the food or its insufficient constituents already mentioned. We observe the same occasionally in neuropathic breast-fed babies with an insufficient supply.

TREATMENT OF ACUTE DYSPEPSIA WITH INTOXICATION (ACUTE ENTEROCATARRH, CHOLERA INFANTUM, ACUTE ALIMENTARY INTOXICATION)

For the purpose of detoxication and to combat the dessication of the body the usual administration of water or tea, sweetened with saccharine, if necessary, in sufficient quantities and the withdrawal of food substances for a short period (six to twelve hours) may be a necessary procedure preliminary to the introduction of any therapeutic feeding. Afterwards food is absolutely necessary. Whatever food is chosen, only small quantities are permitted in the beginning, so as not to provoke an aggravation or return of the intoxication symptoms. Thus during the twenty-four hours following the period of abstinence in addition to the indispensable water or tea five to

twenty grams of protein milk are to be administered, plus 1 to 3 per cent. dextrine-maltose or flour ball ten times. Thereafter the amount has to be increased daily by about 50 grams up to 300 grams *per diem*, at which quantity the danger from hunger is diminished. After cessation of the diarrhœa the daily amount of protein milk must be more rapidly increased to 180 to 200 grams per kilo body weight; while the intervals are lengthened. The percentage of carbohydrates is to be augmented slowly to 5 per cent.

Since the acute drop of body weight with the toxic symptoms has a close relationship to dehydration an early water replacement is urgently indicated. A much better replacement or retention than that obtained by the method mentioned before, results from the early administration of food lacking in fat but containing a sufficient quantity of water-storing substances, namely whey salts; as in whey or buttermilk. Finkelstein and others assert the superiority of buttermilk over the simple whey or skimmed milk. For the prevention of fermentation it is necessary to avoid the addition of crystalline sugars and in their place 1 to 2 per cent. of finest corn-meal (free from fat) or cream of wheat should be used from the beginning; these are not subject to rapid fermentation. Finkelstein in his experience of the last two years obtained thus quicker and with greater certainty the cessation of loss of body weight by water retention.

The procedure would be as follows: After a tea-feeding of from six to twelve hours, according to the weight of the baby ten to thirty grams of whey or buttermilk are given ten times in twenty-four hours, and the daily amount rapidly increased, for instance, by 50 to 100 grams until the loss of body weight is stopped or the amount of 100 to 120 grams per kilo body weight has been reached. Thereafter albumin milk or one of its modifications is gradually added in daily greater quantities with finally an increased percentage of carbohydrates until 200 grams per kilo body weight of the mixture of whey or buttermilk with albumin milk are reached per day. Thereupon the whey or buttermilk is gradually reduced, being replaced by albumin milk. The objection seems justified that by the combination of whey or buttermilk with albumin milk the advantage of the latter may be lost again; however, in such cases as considered, the necessity

of a food rich in salts (whey salts) is so pressing as to outweigh the possible disadvantage. Should an acute loss of body weight now occur, a quantity of whey or buttermilk should be reintroduced. In babies affected with severe dystrophy, especially with decomposition, 100 to 200 grams of whey or buttermilk should be continued in addition to other food mixtures for a long period.

In favorable cases of a prompt detoxication as early as on the second or third day the loss of body weight ceases, even with still very small amounts of food; the stools improve so that a quicker increase of food quantity is possible. However relapses of toxic symptoms may occur with a too hasty, injudicious increase of the food. The most serious conditions and unfortunately often a futile task are faced in severe intoxication of atrophic ("decomposed") young infants. A continued rapid loss of body weight after the first days, in spite of improvement of the toxic symptoms, may occur especially in hydrolabile babies, and should be considered as a possible effect of the inanition. A rapid increase of food even at the risk of a relapse is urged by Finkelstein in order to overcome in a few days the great danger of continued thirst and hunger.

Likewise a difficult task is presented in incomplete detoxication or its failure to appear, as in intoxication with atrophia (decomposition) and infections. A prolonged hunger diet would end catastrophally. Food must be administered and judiciously increased. At least in a number of such most serious instances the cessation of the body weight loss may prove possible; whereupon the daily supply of about seventy calories (130 to 150 grams albumin milk plus 5 per cent. carbohydrate) per kilo body weight, by covering the low maintenance requirement, will allow us to wait until the infection and the intoxication have been overcome, when a further increase of the quantity of protein milk is possible.

APPLICATION OF PROTEIN MILK IN ACUTE DYSPEPSIA

In acute dyspepsia after evacuating the gastro-intestinal tract and a period of abstinence of from six to twelve hours the procedure of administration of protein milk follows the rules and principles laid down in the foregoing pages. The more severe the manifestations are, the more must the application of the food conform with

that in alimentary intoxication; the milder forms naturally allow of a more liberal initial food dosage. Already within the first week at least the food quantum for maintenance should be reached and thereafter the amount of carbohydrate increased, with the addition of flour, if necessary.

FINAL REMARKS

As the results obtained in the great majority of instances are surprising and most satisfactory, physicians are urged to make themselves familiar with the simple principles and the method of administration of albumin milk. Whoever has acquired the necessary experience in its correct application, avoiding certain mistakes in the technic, and keeps in his mind the peculiar composition of this food, possesses in this preparation a therapeutic measure of highest value, broadening the boundaries of curability in his young patients considerably and rendering the artificial feeding successful in many cases that otherwise would succumb or at least offer the greatest difficulties to the attending physician. Basing my comprehensive judgment upon personal experience of the past ten years, gathered in hospital work and private practice and the study of the literature, I do not hesitate to count the introduction of protein milk with its varieties as one of the great achievements in modern pædiatrics and a most important practical step in the dietotherapy of nutritional disorders of infancy. One cannot fail to be impressed with the generally very favorable verdict of most writers on this subject. However, a close adherence to the directions detailed by Finkelstein and Meyer is necessary to obtain full results.

BIBLIOGRAPHY

FEER, E.: "Text-book of Pædiatrics." American Edition, translated from the German by J. P. Sedgwick and C. Scherer. J. B. Lippincott Co., Philadelphia, 1922.

FINKELSTEIN AND MEYER: *Jahrbuch f. Kinderh.*, 1910, v. 71.

FINKELSTEIN, H.: "Lehrbuch der Sauglingskrankheiten," Berlin, 1921.

HELBICH: *Monats. f. Kinderh.*, 1910, No. 9.

DAVIDSON, H.: "Die künstliche Ernährung Neugeborener und junger Säulinge in Anstalten," *Zeitschr. f. Kinderh.*, 1922, vol. 31, p. 367-368.

GRIFFITH, J. P. C.: "Diseases of Infants and Children," vol. 1, pp. 148 and 168.

SAUER, L. W.: "Powdered protein milk as a prophylactic food for young infants," *Arch. of Pædiatrics*, 1922, v. 39, p. 1-10.

Clinical Medicine

SOME POINTS IN THE DIAGNOSIS, PROGNOSIS AND MEDICAL TREATMENT OF GALL-BLADDER DISEASE

By SIR HUMPHRY ROLLESTON, K.C.B., M.D., D.C.L., F.R.C.P.
Emeritus Physician, St. Georges Hospital, London

An inclusive heading of gall-bladder disease for gall-stones and cholecystitis is convenient, for although a distinction is drawn between these two in systematic treatises they are very closely bound together, being so often successive or alternating stages in the patient's history. Unless a calculus is found by X-rays or in the stools a diagnosis of cholelithiasis is open to question, and yet it is much more frequent than the less committal one of cholecystitis, which being interpreted in the original sense means disease of the gall-bladder. It is true that the termination *-itis* now has a universal significance of inflammation, but it was not ever thus. Some thirty years ago discussion arose as to the propriety of using neuritis for various forms of peripheral neuritis in which there was degeneration but no inflammation of the nerves. The origin of the termination *-itis* was then after much enquiry found to be merely a Greek feminine adjectival termination agreeing with *νόσος* (disease) understood, so that neuritis is the short for *ἡ νευρίτις νόσος* (the disease of the nerves).

ETIOLOGY

Familiarity with the causation of gall-bladder disease and gall-stones is obviously essential in successful diagnosis and treatment. Cholecystitis is due to infection and gall-stones are generally the result of cholecystitis, but a certain number of gall-stones, those composed of cholesterin alone, are formed independently of any inflammation in the gall-bladder as a result of excess of cholesterin in the blood, such as occurs during pregnancy. These gall-stones need not cause symptoms, but their presence favors stasis and infection of the gall-bladder, and so may lead to the formation of multiple ordinary calculi.

Gall-bladder disease is most common in women who have borne children, are getting fat and into middle life, "fair, fat, flatulent, fertile, and forty," an alliterative account expanded from a Philadelphia aphorism. It is said to be ten times more frequent in women who have borne children than in the sterile. This may be referred to several factors—the excess of cholesterin in the blood, derived from the corpora lutea and adrenals (Chauffard), during pregnancy, the liability to puerperal infection, and sedentary habits. But it is not confined to women for it occurs in men in the proportion of about 20 per cent. of all cases. Cholecystitis is particularly prone to occur in connection with certain forms of infection, namely those of the alimentary canal, especially appendicitis, and the tonsils; and as tonsillar infection is so often secondary to oral sepsis, pyorrhœa must not be forgotten. Streptococci from the throat appear to have a predilection for the gall-bladder (Rosenow). Enquiry for a past history of enteric fever, in which the gall-bladder serves as a reservoir for typhoid or paratyphoid bacilli, should always be made especially when gall-bladder inflammation appears before middle life; but at the present time there is a reaction against the view that enteric fever is responsible for the majority of the cases of gall-bladder disease; McGuire[1] estimated that enteric fever was a causal factor in only 10 per cent. of gall-bladder cases. Out of 161 gall-stone cases Chauffard[2] obtained a history of enteric fever in 25, or 19 per cent., and among Blaxland's[3] 100 cases there was a history in 5 only. Probably the reason why enteric fever has been given such a prominent place in the etiology is that its occurrence is such a prominent landmark in the history of the patient. It is significant that typhoid fever has become relatively very rare in this country whereas gall-stones are not. Riesman[4] noticed that in 42 per cent. of his cases there had been a previous operation—in one-third for tonsillectomy and in another third for appendectomy, often, he significantly adds, on an erroneous diagnosis.

[1] McGuire: *Surg., Gyn., and Obstet.*, 1920, xxxi, 617.

[2] Chauffard: "Leçons sur la lithiase biliaire," Paris, p. 36, 1914.

[3] Blaxland: *Practitioner*, 1914, xcii, 646.

[4] Riesman: *Penna. Med. Jour.*, 1919, xxiii, 120.

CLINICAL MANIFESTATIONS

In the early stages of slight cholecystitis the symptoms and signs are vague and consist of indigestion and slight abdominal pains, and their nature is often unrecognized. It is this stage of the disease that it is so important to bear in mind and to investigate, so as to obtain reliable information for its detection, and so for preventive and curative measures. But at present in the absence of any physical signs in connection with the gall-bladder there is no reliable means of diagnosis, though the history, for example of past jaundice, even many years ago, may suggest this origin, especially when by a process of exclusion other causes, such as appendicitis and duodenal or gastric ulcer, appear to be improbable. Possibly Lyon's method of aspirating the bile by the duodenal tube (see p. 121) may provide a method of such early diagnosis.

Tenderness over the gall-bladder may be superficial and referred to the skin in the seventh, eighth, and ninth thoracic segments, or it may be deep and brought out when pressure is brought to bear on the gall-bladder. It is one of the most constant diagnostic signs of gall-bladder disease; it often disappears after an attack, or perhaps it would be wiser to say that it is not detected because the gall-bladder is contracted and well covered by the liver. In an analysis of 500 cases of gall-bladder disease Bodenstab[5] found that deep tenderness was recorded in 94 per cent. of the cases without calculi and 86 per cent. of the cases with calculi. Success in eliciting deep tenderness depends largely on the method employed to detect it; and in this connection attention may be called to two methods described by the late J. B. Murphy.[6] In *hammer-stroke percussion* for detection of acute infection of the gall-bladder or acute obstruction of the cystic or common bile duct, with or without infection, the examiner sitting on the right side of the recumbent patient places his hand from above over the costal arch and presses the tip of the second finger of the left hand, flexed at a right angle, firmly up under the costal arch at the tip of the ninth rib; the patient then takes a deep breath, and at the height of the inspiration when the gall-bladder is forced below the costal margin the flexed finger is struck forcibly with the ulnar

[5] Bodenstab: *Jour. Amer. Med. Asso.*, Chicago, 1918, 71, 12.

[6] "The Surgical Clinics of John B. Murphy, M.D.," 1912, I, 460-465.

side of the examiner's right hand, and if there is inflammation or retention in the biliary tract the patient has severe pain. In "deep-grip palpation" the examiner standing behind the patient curls his right hand up under the costal arch at the tip of the ninth costal cartilage and at the end of the expiration seeks the gall-bladder; commencing inspiration and descent of the diaphragm brings down the gall-bladder, and in the presence of cholecystitis or gall-stones "the descent is checked suddenly with an accompanying groan from the patient, for the diaphragm, acting as the great piston of respiration, forces the distended, inflamed, or congested gall-bladder down upon the firmly fixed hand."

During an attack the gall-bladder may be distended and palpable from obstruction of the cystic duct either by inflammatory swelling of its mucous membrane or from a calculus; this swelling may rapidly disappear or may come and go, this intermitting distension being usually explained as due to a calculus moving in and out of the proximal ends of the cystic duct. Palpation of the gall-bladder, and it will be remembered that it is never palpable in health, may be facilitated by putting a small pillow behind the hepatic region. The presence of an elongation of the right lobe of the liver—Reidel's lobe—is often present in gall-bladder disease. Enlargement of the liver during an attack of gall-stones or cholecystitis is difficult to detect with certainty on account of the rigidity of the overlying muscles and Sir James Mackenzie[7] in pointing out this fallacy as to a "tender and enlarged liver" has never been able to satisfy himself about a slightly enlarged liver when hyperalgia and contracted muscles are present. But out of 30 cases of biliary infection examined after operation 26, or 87 per cent., showed distinct enlargement of the liver due to leucocytic infiltration around the bile ducts.[8]

Tender spots may be found in various positions in addition to those over the gall-bladder and the biliary point, midway between the tip of the ninth rib and the umbilicus. Deep tenderness to the right of the spine between the seventh and eighth ribs is regarded as pathognomonic of pericholecystitic adhesions by Friedman and of more value than X-rays; but tenderness in this region may also be due

[7] Mackenzie: "J. Symptoms and their Interpretation," p. 156, 1909.

[8] Peterman, Priest and Graham: *Arch. Surg.*, Chicago, 1921, ii, 92.

to inflammation around or in the right kidney; in the absence of evidence of renal disease it has seemed to me to be of value in the diagnosis of biliary affections. Chauffard has described tender points over the spines of eighth to eleventh dorsal vertebræ, the tip of the eleventh rib on the right side, the right shoulder, the inferior angle of the right scapula, and over the right phrenic nerve between the two heads of the sterno-mastoid muscle.

JAUNDICE

The omission to diagnose inflammation of the gall-bladder depends in part on the erroneous assumption that jaundice should be present. As a matter of observation cholecystitis alone, and as long as the inflammation does not extend into the common bile duct, does not give rise to jaundice; the occurrence of jaundice, therefore, shows that there is something more than cholecystitis; these complications may be cholangitis, the passage of a calculus or thick mucus into the common bile duct, or inflammation of the head of the pancreas. In Bodenstab's 500 cases of gall-bladder disease jaundice was noted in 8 per cent. of the non-calculous cases and in 23 per cent. of the calculous cases. The higher number in the second group being presumably due to the passage of calculi into the common duct. Though less rare in gall-stone disease than in simple cholecystitis, jaundice should not be regarded as a common result of cholelithiasis, thus the late J. B. Murphy[9] of Chicago insisted that 86 per cent. of gall-stone cases did not show jaundice.

The temperature in cholecystitis varies; in suppurative cases and when associated with a stone or inflammation in the cystic or common ducts it may be high and swinging. Murphy[10] laid down the rule that infection of the gall-bladder alone rarely gives rise to a temperature above 101°F., but that when the cystic or common duct is infected temperatures of 103° to 106°F. may occur. The explanation is that the lymphatics of the gall-bladder are scanty and so absorption is inhibited whereas the rich lymphatic supply of the ducts favors rapid absorption.

The obstinate dyspepsia insisted on by Sir Berkeley Moynihan

[9] "Surgical Clinics of J. B. Murphy," 1912, i, 139.

[10] *Ibid.*, 1912, i, 425.

as the masked or inaugural symptom of gall-stones and often called gall-bladder dyspepsia may precede for years any obvious clinical evidence that the gall-bladder is the source of this reflex indigestion. With the appearance of clinical manifestations definitely indicating that the gall-bladder is affected the dyspeptic symptoms may disappear. The dyspepsia varies to some extent, but is characterized by its resistance to ordinary treatment; it may come on directly after a meal, but usually it is delayed for three or more hours, often occurring in the middle of the night, and so imitates a duodenal ulcer. Flatulence, largely due to swallowing air—an explanation that few patients and not every medical man will accept—is a prominent feature, and examination of the abdomen often reveals a splash in the stomach hours after food, when it should be empty, probably due to reflex spasm of the pylorus. In about 5 per cent. of the cases of gall-bladder disease gastric hemorrhage has been reported (Crispin) and so increases the resemblance to peptic ulcer. The inaugural dyspepsia preceding obvious symptoms of gall-bladder disease must be distinguished from the persistent pyloric obstruction due to pericholecystitic adhesions that may follow long continued cholecystitis and sometimes necessitate a second operation after successful removal of gall-stones. In these cases an X-ray bismuth meal is of great assistance in making a correct diagnosis. Referred pain to the right shoulder or down the arm, or lumbago is another form of the masked manifestations of gall-bladder disease.

Septicæmia of Gall-bladder Origin.—An acute cholecystitis or an acute infection supervening on a damaged or chronically infected gall-bladder may give rise to hæmic infection; typhoid septicæmia without a history of typhoid fever (Fiessinger)[11] or *B. coli* septicæmia (Monziols and Collignon)[12] has thus been known to occur. In such instances the kidneys and livers may bear the brunt of the disease, with jaundice, enlargement of the liver, and pyuria and albuminuria, or hepatonephritis; or there may be malignant endocarditis or even meningitis. The renal infection in these cases of septicæmia of biliary origin is not easy to separate from pyelitis due to infection

[11] Fiessinger: *N. bull. et. mém. soc. méd. d. hôp. de Paris,* 1920, 3 e sér., xliv, 506.

[12] Monziols and Collignon: *Ibid.,* 1920, 463.

of the pelvis of the kidney by *B. coli* (see below), but the clinical symptoms are more severe.

REMOTE RESULTS OF GALL-BLADDER DISEASE

Gall-bladder dyspepsia, often an early symptom before the underlying cause is suspected, has already been mentioned. The most important remote effect of gall-bladder disease is cardiac insufficiency; it may lead to serious hesitation in recommending operation urgently needed in other respects. "The cholecystitic heart," due to myocardial change, is usually regarded as caused by toxins absorbed from the gall-bladder; it has, however, been thought to depend on the action of bile salts in the blood rendering the muscle cells of the heart responsive to both positive and negative ions instead of to one only (Flint). The biliary origin of myocarditis may not be obvious and so escape recognition, the cases coming under observation as cardiac failure. Attacks of angina may precede the manifestations of myocardial failure; and here it may be mentioned that biliary colic may occur on the left side, possibly in connection with adhesions around the gall-bladder, and may then imitate angina pectoris; but these cases are different from those of angina preceding cardiac failure of biliary origin. I have seen well-marked auricular fibrillation in the course of gall-stone disease, and watched the recovery after an operation attended by great anxiety. Existing valvular disease previously compensated may become serious from myocardial failure of biliary origin. It is important to realize that the cardiac condition is due to the gall-bladder, and that the best chance, to remove the cause, which is usually attainable only by operation. Otherwise if operation is considered to be contra-indicated by the state of the heart, the patient is left in a condition certain sooner or later to prove fatal.

Infection of the pelvis of the kidney, usually on the right side, with *B. coli* may complicate cholecystitis and unless the pyelonephritis is recognized the severe symptoms thus caused, which usually disappear when the urine is rendered alkaline by sufficient doses of potassium citrate or sodium bicarbonate, may appear to call urgently for operation on the gall-bladder. In a patient known to have chronic gall-bladder disease an acute *B. coli* infection of the urinary tract is very easily missed unless a systematic examination of the urine is

made. Even when the existence of pyelitis in such cases is recognized, the question of concomitant cholecystitis may cause anxiety; in this circumstance it is better to treat the *B. coli* pyelitis vigorously with alkalies and to await the result of this before calling for operation on the gall-bladder.

Femoral phlebothrombosis is another infective complication that may follow chronic gall-bladder disease, and in relapsing cases of phlebitis the gall-bladder should be thought of as a possible focus.

Chronic infective arthritis, formerly called rheumatoid arthritis, may be secondary to gall-bladder infection, but it is not a common complication of gall-bladder infection, probably because the liver exerts a filtering and detoxicating influence.

DIAGNOSIS

The question whether or not gall-stones are present is often very difficult. Extremely severe colic may occur in cholecystitis alone and be due to blocking of the cystic duct by an extension of inflammation. So the general tendency to ascribe severe and paroxysmal colic to calculi, and less severe but more prolonged pain to cholecystitis cannot be regarded as conclusive, but in cholecystitis the pain is continuous, deep, and aggravated by pressure. Deep tenderness over the gall-bladder would seem to be the most constant sign in both cholecystitis and gall-stones, for Bodenstab found it in 94 per cent. of the non-calculous and 86 per cent. of the calculous cases of gall-bladder disease. It points to inflammation of the gall-bladder, which so very commonly accompanies gall-stone colic. On the other hand, the longer chronic cholecystitis has existed the more probable the presence of gall-stones. Jaundice, after the attack, appears to be more frequent in calculus cases than in those without stones. The detection of a calculous in the fæces after an attack is of course decisive, but the failure to do so is not of any value.

From the intimate anatomical, physiological, and pathological relations of the parts concerned the differential diagnosis between *peptic ulcer* of the stomach and duodenum on the one hand and gall-bladder disease on the other hand, though in many cases easy enough, may be extremely difficult, and it must be admitted that a distinction is not always possible. Thus out of 954 operations undertaken for

disease of the biliary tract Kehr found 94, or 10 per cent., to be duodenal ulcer, and even when exposed to view it may be difficult to decide in which of the parts, matted together by adhesions, the disease started. It must also be remembered that peptic ulcer and gall-bladder disease may co-exist. The value of a careful clinical history in forming a diagnosis is nowadays in danger of being cast into the shade by X-ray and laboratory examinations. Clinically nausea, distaste for food, and gastric irritability are more prominent in gall-bladder disease. Parturier[13] regards weak breathing at the right base as a valuable sign of gall-bladder disease, but my limited experience points to its occurrence, due to immobility of the right side of the diaphragm, as present in other subdiaphragmatic conditions, such as appendicitis. Extension of pain to the right shoulder is in favor of gall-bladder implication, and occult blood in the fæces points to peptic ulcer, but it is not pathognomonic, for at the Mayo Clinic it was found in 5 per cent. of gall-bladder cases (Crispin), ulceration in the biliary tract from calculi or inflammation may be the responsible factor. By means of X-rays the presence of gall-stones or of peptic ulcer may be shown, but adhesions between the gall-bladder and the pyloroduodenum are ambiguous. A deficiency in HCl in the gastric juice is in favor of gall-bladder disease. The therapeutic test of giving alkalies, such as 2 drams (Chauffard) of bismuth carbonate, which relieves the pain of ulcer but does not affect that of gall-bladder disease, may be tried. Examination of the blood shows an excess of cholesterin in cholelithiasis but none in peptic ulcer. Analysis of the contents of the gall-bladder obtained by aspiration through a duodenal tube, as practiced by Lyon, will no doubt be largely used in the future in the diagnosis of cholecystitis.

Chronic Appendicitis.—As both gall-bladder and appendix dyspepsia are reflex manifestations, the symptoms are much the same and the differential diagnosis turns on physical signs such as deep tenderness over the gall-bladder or appendix and X-ray appearances of these outlying parts of the alimentary canal. In favor of appendicitis is local tenderness and radiation of pain into the right iliac fossa, tenderness per rectum towards the right sacro-iliac joint, and Bastedo's sign, namely localized pain and deep tenderness in the appendix region

[13] Parturier: *Rev. de méd.*, Paris, 1921, 289.

on inflation of the colon. It should be added that the gall-bladder and appendix are not uncommonly both in a condition of chronic inflammation.

Disease of the Pancreas.—Carcinoma of the pancreas, usually in the head and then producing absolute and progressive obstructive jaundice, is accompanied by a distended gall-bladder, whereas in chronic cholecystitis and gall-stones in the common duct jaundice, if present, is not associated with a palpably enlarged gall-bladder (Courvoisier's law). Mild attacks of acute pancreatitis may imitate cholecystitis; swelling of the head of the pancreas may compress the common bile duct and so jaundice, which is rare in cholecystitis, may occur. Robson indeed has described catarrhal pancreatic jaundice. Chronic pancreatitis may reflexly cause gastric symptoms, and Nicoll[14] considered that after the gall-bladder and appendix it is the most important cause of the reflex dyspepsia imitating peptic ulcer. The differential diagnosis depends on recognition of pancreatic insufficiency and is therefore shown by laboratory tests. In other cases chronic pancreatitis compresses the common bile duct causing jaundice and so resembles a calculus in the common duct.

The pain of gastric crises of tabes may be regarded as biliary colic and the patients be submitted to a fruitless operation on the gall-bladder.

Although hardly any attention has been called to it, there may be considerable difficulty in distinguishing *carcinoma of the hepatic flexure of the colon* from gall-bladder disease. The contents of the colon at this point are fairly liquid so that the ordinary obstructive symptoms are late in appearing. I have seen four cases in which carcinoma of the hepatic flexure of the colon suggested disease of the gall-bladder in that there was a tumor in the gall-bladder region with attacks of pain; three of these were in women; in one of them there were albumin, blood, and blood casts in the urine. In one, a woman, seen in the Norwich and Norfolk Hospital with Dr. F. W. Burton-Fanning and Sir Hamilton Ballance, had a sudden onset of pain in the right upper quadrant, resembling that of perforation, followed by fever and enlargement of the liver or gall-bladder; later the tumor was thought to be renal but the urine was normal; at the

[14] Nicoll, J. H., *Brit. Med. Jour.*, 1919, ii, 625.

necropsy there was carcinoma of the colon perforating into the liver. In such cases an X-ray bismuth meal and the discovery of occult blood in the fæces should point to carcinoma of the colon.

Right-sided pleurisy or pneumonia is well known to imitate appendicitis, but they may also simulate gall-bladder disease; as a sign of very early pneumonia is weak breathing over the acutely congested lung it should be remembered that in cholecystitis the right half of the diaphragm may be reflexly fixed and as a result the respiratory murmur over the right side of the chest is diminished (Ramond, Vincent, and Clement).[15]

The nerve-root pains of spondylitis (vertebral arthritis) may simulate abdominal visceral disease; Vanderhoof[16] and Allan and Squires[17] have reported cases in which laparotomy was done for supposed gall-stones.

PROGNOSIS

There has been much difference in the estimate made of the importance of gall-bladder disease from the point of view of clinical symptoms. As gall-stones are in the great majority of cases a product of gall-bladder disease the opinions expressed about the clinical significance of gall-stones may be briefly quoted. Kehr[18] twenty years ago stated that only 5 per cent. of persons carrying gall-stones suffered from them, and in 1920 Lewellys Barker[19] estimated that only 10 per cent. of persons with gall-stones have well-marked symptoms. As a contrast to this opinion expressing the optimism of the physician is that of the operating surgeon; thus W. J. Mayo[20] wrote a paper entitled "Innocent Gall-stones— a Myth," and Moynihan is emphatic that all gall-stones cause symptoms, though he has recently made an exception for the single pure cholesterin calculi.

There can be no question that recurrent attacks are prone to occur after an acute gall-bladder inflammation. It is usually impossi-

[15] Ramond, Vincent, and Clement: *Bull. et mém. Soc. méd. des. hôp. de Paris*, 1920, 3e sér., xliv, 619.

[16] Vanderhoof: *Jour. Amer. Med. Asso.*, 1920, lxxiv, 1689.

[17] Allan and Squires: *Southern Med. Jour.*, 1918, xi, 373.

[18] Kehr, H.: "Diagnosis of Gall-stone Disease," p. 26, Amer. Transl., 1901.

[19] Barker, L. F.: *Jour. Amer. Med. Assoc.*, 1920, lxxvi, 1108.

[20] Mayo, W. J.: *Jour. Amer. Med. Assoc.*, 1911, lvi, 1021.

ble to be certain whether or not these attacks are associated with and due to gall-stones; usually the passage of a stone is accompanied, and very possibly caused by, cholecystitis, but I do not think that this is, at any rate always, so, when there are a large number of small calculi. These are the cases most rebellious to medical treatment. In addition to the passage of small calculi there are other causes of recurrent attacks or relapse of gall-bladder symptoms. Severe exertion by stretching or rupturing cholecystitic adhesions may set up inflammation, which may also follow injury, massage, or jolting on a rough road; and an attack may follow a thorough clinical examination so closely as to appear to be more than a coincidence. Re-infection as the result of food-poisoning, an attack of influenza or other acute infection, and the injection of a typhoid or streptococcic vaccine may excite an attack. Some caution is necessary in accepting food-poisoning as a cause of cholecystitis as the vomiting and pain due to cholecystitis may be erroneously regarded as due to food which is really innocuous. The liability of anti-typhoid inoculations to cause a relapse in patients with chronic cholecystitis is fully recognized. A year ago I saw a woman who had successive attacks closely supervening on inoculations of a streptococcic vaccine for nasopharyngitis; after omitting the vaccine the attacks stopped for some months, but subsequently returned and operation revealed numerous minute calculi in a gall-bladder with little or no evidence of chronic cholecystitis. As microörganisms remain latent in the wall of the gall-bladder slight causes, often unperceived, may enable them to become active, or very possibly the immunity against them is of short duration so that the periodic attacks are thus explained. Or it may be that a primary focus of infection, *e.g.*, in the tonsils or appendix, is continually re-infecting the gall-bladder and supplying it with a toxin or foreign protein to which the gall-bladder has become sensitized, as suggested by attacks set up by the injection of anti-typhoid and streptococcic vaccine. It is possible that removal of a primary focus may be followed by quiescence of a gall-bladder previously prone to relapsing attacks; but this is certainly not universal for cases in which a diseased appendix is removed and a chronic cholecystitis left may require a further operation on the gall-bladder for persistence of the symptoms.

Malignant Disease of the Gall-bladder.—Although gall-stones are present in over 90 per cent. of the cases of primary carcinoma of the gall-bladder, it is remarkable how often the calculi remain latent and have not given rise to symptoms. This was well shown in a series of 48 cases of primary carcinoma of the gall-badder analyzed by Fawcett and Rippmann[21] who point out that a history of colic is in favor of gall-stones without malignant disease, and that in cases of cholelithiasis surgical interference should not be, as it often is, urged on the grounds that carcinoma is likely to supervene.

Prophylaxis.—This falls under the main heads of (1) prevention or removal of focal or other infections that may spread to the gall-bladder, such as oral sepsis, tonsillitis, sinusitis, appendicitis, pelvic infections after delivery. After enteric fever, in which bacilli are constantly present in the gall-bladder, the administration of hexamine is advisable to prevent inflammation of the gall-bladder. (2) Attempts to prevent an excess of cholesterin in the blood. The cholesterin content of the blood is increased during pregnancy and after enteric fever, and some persons have a tendency to retain cholesterin just as some individuals retain uric acid; incidentally it may be mentioned that it has recently been found that in gouty persons hyper-uricæmia and hyper-cholesterinæmia are both present (Chauffard, Brodin, and Grigaut).[22] Cholesterin comes mainly from food, such as the yolk of eggs, cream, butter, fish, meat, and peas; hence these should be somewhat restricted in persons who have had any suggestion of cholecystitis, and excess of yolk of egg avoided in convalescence from enteric fever. (3) In order to prevent stagnation of bile in the gall-bladder, which would favor deposition of cholesterin and infection of the gall-bladder, meals small in amount, should be taken in the middle of the morning, at 4.30-5 P.M., before going to bed, and during the night should wakefulness occur. Biliary stasis should also be obviated by deep breathing and exercise.

Medical Treatment.—The dietetic precautions and measures to minimize biliary stasis should be continued after an attack. A mixture containing hexamine, which has been shown experimentally to remove gall-bladder infection even though the bile is alkaline,

[21] Fawcett and Rippmann: *Guy's Hosp. Rep.*, 1913, lxvii, 41.

[22] Chauffard, Brodin, and Grigaut: *Compt. rend. Soc. biol.*, Par., 1920, 672.

salicylate of sodium which acts as a chologogue thus increasing the flow of bile and washing out the gall-bladder, benzoate of sodium, bicarbonate of sodium, spirit of chloroform, and infusion of cloves to the ounce should be taken three times a day before food. Oleate of sodium has a certain amount of chologogue action, and as eunatrol or in the form of a pill with various substances such as methylene blue and aspirin, may be given instead of or in addition to the hexamine and salicylate of sodium prescription.

Direct non-surgical drainage of the gall-bladder and bile ducts by the suction method exerted by Einhorn's duodenal tube has been practiced by Lyon in Philadelphia and at the Mayo Clinic, Rochester. In order to understand the method a brief reference must be made to the following points: Normally there is antagonism between the musculature of the gall-bladder and Oddi's sphincter at the lower end of the common bile duct; when one contracts, the other is relaxed; except when food is passing through the duodenum and bile is expelled by the contraction of the gall-bladder, the lower end of the bile duct is closed by tonic contraction of Oddi's sphincter. Meltzer, who in 1917 formulated the law of contrary innervation as applied to the emptying and filling of the gall-bladder, showed that the application of a solution of sulphate of magnesium applied directly to mucous membrane of the duodenum caused relaxation of Oddi's sphincter. According to Meltzer this does not occur when the magnesium sulphate is taken by the mouth. Lyon[23] has put these physiological observations into practice in the diagnosis and treatment of diseases of the biliary system: Twelve hours after a meal a duodenal tube is passed, and after washing out the stomach to avoid contamination, the duodenum is sprayed with 75 c.c. of a 33 per cent. of magnesium sulphate; the duodenal contents are then gently aspirated, and bile is withdrawn first from the common bile duct, then from the gall-bladder, and then from the intrahepatic ducts; the bile from these three portions of the biliary system being distinguishable by its color. The bile is directed into three different bottles. Normally the gall-bladder contains 1½-2½ ounces of dark yellow bile, but in atony it may contain 6 ounces, and in cholecystitis it is much altered in appearance. Chemical, microscopical, and bacteriological

[23] Lyon, B. B. V.: *Am. Jour. Med. Sc.*, Phila., 1920, clx, 515.

examinations of the three different samples of bile can then be made to show what part of the biliary system is affected and what micro-organism is present. In cases of cholelithiasis the bile may convey a gritty feeling to the finger and microscopically show masses of precipitated bile. By this method of medical drainage not only an early and accurate diagnosis can be made, but cholecystitis may be successfully treated in early stage.

Medical treatment certainly has its limitations and when these are obvious and the diagnosis of gall-bladder disease seems clear the surgeon should be called in for consultation.

SOME GENERAL CONSIDERATIONS REGARDING THE ETIOLOGY OF THE RESPIRATORY INFECTIONS

BY MILTON W. HALL, M.D.,

Major, Medical Corps, U. S. A., Washington, D.C.

The study of the various infections of the respiratory tract, endemic and epidemic, with a view to the discovery of practical means for their prevention, has brought to mind a few general considerations which may prove of value not only in the respiratory affections themselves, but are possibly also of more general application in other diseases. The consideration of these diseases as a group from the standpoint of etiology at once brings out the fact that no one of the so-called common respiratory diseases, though fairly distinct entities clinically speaking, has associated with it a specific organism that can be assigned the definite rôle of inciting the disease. Even in the case of lobar pneumonia, the pneumococcus is not always the inciting cause, and among the pneumococci recent work has shown the existence of a multiplicity of serologically distinct races. The pneumococcus, in other words, should apparently be referred to rather as the "pneumococcus group." All the bacteria commonly found in respiratory infections, pneumococci, streptococci, staphylococci, and hæmophilic bacilli appear to be groups of similar, closely related, but readily distinguishable races of bacteria, and the more closely they are studied the more evident is this heterogeneity within the group. Yet these respiratory infections appear in epidemic and sub-epidemic waves very frequently. The great variety of bacteria isolated during such outbreaks, of different groups and different races within the groups, renders it improbable *a priori* that any of them are the primary cause of such epidemics. It seems impossible to avoid the conclusion that if a given epidemic be due to a single cause, all persons infected by the spread of microörganisms directly or indirectly from one patient to another, must harbor organisms that are the progeny of these in the original case, and must therefore be identical. When heterogeneous bacteria are found in an outbreak of a disease the assumption is justified that their presence is accidental or at least

incidental to the true origin of the disease. This of course is the reasoning applied by Park to the study of the relation of the Pfeiffer bacillus to epidemic influenza.

Consideration of the known pathogenic microörganisms of all classes suggests that they may be divided into two groups along a line not hitherto emphasized to the extent to which perhaps the distinction is entitled. It is well established that certain pathogens are always associated with certain particular diseases. The demonstrated presence of such organisms in a patient is generally accepted as proof either of infection or of former infection and the existence of the carrier state. While in some instances definite history of prior disease may not be obtainable, in most cases it is so, and the proof that the carrier state may arise without previous infection and disease is difficult or impossible to obtain. The list of organisms that may be placed in this group includes the typhoid bacillus. This organism is not known to occur in man except in the presence of the disease or in carriers who have had the disease in the past. The *Treponema pallidum* and the gonococcus are found only in association with the corresponding disease. The diptheria bacillus is probably a member of this class, though the existence of carriers of virulent bacilli who give no clear history of the disease is conceded. In this disease there are undoubtedly many cases of mild and unrecognized infection that may give rise to the carrier state. The tubercle bacillus, the glanders bacillus, the bacillus of bubonic plague, the cholera vibrio, the organism of anthrax, malaria, yellow fever, and many others may be grouped in this class of *obligate pathogens.*

On the other hand there is a large number of organisms which, while of undoubted pathogenicity, are not invariably or even as a rule associated with specific diseases. Such organisms are found more or less constantly on the mucous membranes and in the secretions of men and animals. They are perhaps not usually associated with disease in any form. When they do produce disease its manifestations lack the uniformity characteristic of that produced by a member of the former group. They appear to require for the initiation of their pathogenic activities some reduction of the normal defensive powers of the host such as that induced by traumatism or previous disease. In other words it is a group of low invasive powers though often of high patho-

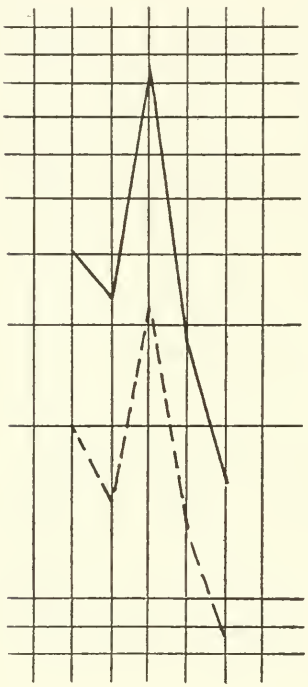
genicity once invasion has been accomplished. It is perhaps a group to which the human animal has acquired a considerable degree of immunity from long association, but which is constantly lying in wait for the moment of reduced resistance when an attack may be successfully launched. The familiar organisms of this group are the pyogenic cocci, including the pneumococci of the so-called mouth types, the colon bacillus, hæmophilic bacilli, *B. pyocyaneus* and a host of more or less definitely recognized bacteria found in wounds and secondary infections. There are undoubtedly a few organisms whose position in this classification is uncertain. For example, the pneumococci Types I and II. These are certainly usually associated with lobar pneumonia, but have been found in the saliva of contacts of corresponding cases without the development of the disease and are also found in a small but definite number of healthy persons who have not been in recent contact with pneumonia. Epidemics of Type I pneumonia occur in a way to suggest the primary significance of this organism, and on the other hand a certain proportion of pneumonias in secondary outbreaks is also associated with pneumococci of the fixed types. The organisms thus appear to act at times as obligate pathogens while usually appearing to belong to the second group.

The invasion of the body and production of disease by members of this second group, or what might be called *facultative pathogens* may safely as a rule be attributed to some reduction of resistance on the part of the individual. When such disease occurs sporadically, such reduction of resistance presumably results from causes peculiar to the individuals attacked and the various cases bear no relation to each other. When, however, large numbers of such cases occur at one time, approaching the proportions of an epidemic, it is logical to believe that the causes of the reduced resistance are resident in the environment rather than within the individual himself. The search for the definite environmental factors that induce epidemics of common respiratory disease for instance is complicated by the fact that apparently a number of conditions may at times reduce the resistance of people in mass, and some have been especially operative in military concentration of population such as those in the great training camps during the war.

Such possible factors are insufficient or improper food supply,

insufficient clothing, exposure, fatigue, and overcrowding in poorly ventilated living quarters. In the causation of the great numbers of respiratory cases that occurred in the first winter of the recent mobilization deficient food supply qualitatively or quantitatively, and the effects of excessive fatigue and exposure can safely be disregarded.

Fig. 1.



The relationship between the incidence of the common respiratory diseases, shown by solid line, and the pneumonias, shown by the broken line, in twenty army camps in the spring of 1918. (Drawn to a logarithmic scale.)

That these causes are to some extent operative in the general population and in individual cases is probable and generally conceded. It is highly improbable, however, that such causes induce the frequent epidemics of respiratory disease which attack persons in all walks of life indiscriminately. In some camps there was for a time during the first winter a shortage of heavy clothing. This condition did not obtain generally while the epidemic occurrence of respiratory disease did so obtain. Hence insufficient clothing cannot be regarded as a primary cause of the condition, though it undoubtedly intensified it in some camps. The question of overcrowding, especially of recruits from rural districts, by concentrating in unaccustomed conditions a large number of susceptible persons has received a great deal of attention. That under such conditions the transference from person to person of bacteria from occasional cases is more easily accomplished would seem to need no demonstration. The further assumption, however, that the slightly pathogenic flora of the upper respiratory tract is thus, by repeated passage through susceptible individuals, increased in virulence and invasiveness is a purely speculative one. This will be considered more fully later. At this time it is desired to call attention to a further possibility, also largely speculative at present but supported by analogy and by some experimental evidence.

This is that these respiratory diseases, when occurring in epidemics may be the complications or sequelæ of some unrecognized infection, itself transient and producing comparatively insignificant clinical manifestations in the great majority of cases. An infection of the general character of the common cold, for instance, which of course is well known to predispose to pharyngitis and bronchitis, perhaps in weakened individuals to broncho-pneumonia. Certain other well-known diseases are also known to have this effect on the respiratory tract. Leaving influenza out of consideration for the moment, measles, for example, is especially apt to result in pneumonia and almost always in bronchitis. The bacteria found in these measles cases are variable in different cases and different localities, and are all members of our facultative group of pathogens. Canine distemper is another disease that owes its mortality to respiratory complications, in this case excited by the common bacteria of the canine respiratory tract. The virus of hog cholera predisposes to invasion by the bacillus suipestifer, an organism often found without the coincidence of the disease. This list may possibly be extended indefinitely. In all these instances the bacteria operative are those usually carried in the mucous membranes of healthy individuals. In some cases they have at one time or another been considered responsible for the primary disease.

The demonstration by Olitsky and Gates of an anærobic, Gram-negative, filter-passing organism in cases of influenza, a discovery that has received substantial confirmation at the hands of Loewe and Zeman, Gordon and others, also tends to support the hypothesis of the entirely secondary rôle of the facultative pathogens in epidemics apparently caused by this group.

This organism, *Bacterium pneumosintes,* has apparently very slight pathogenic action of itself. Its effects are transient and require, in experimental animals, careful study for their demonstration. However, it would appear that it causes a marked predisposition to localization of various other organisms in the lungs with the production of pneumonia. This occurs experimentally and accidentally in animals inoculated with *pneumosintes* alone. In this latter case the bacteria found active are those usually found in the respiratory tracts of the animals used. This would appear to be the outstanding patho-

genic action for this organism as seen in animals. The parallelism is evident between this effect and that of the influenza virus which usually produces a mild transient effect on the patient but which markedly predisposes to infection of the respiratory tract by organisms usually carried in the mouth.

The occurrence of epidemics of disease apparently caused by facultative pathogens has often been attributed to invasion by a special strain of organism, either one of special virulence and invasiveness, due to repeated passage through human hosts, or a strain having a special elective affinity for some organ or tissue as suggested by Rosenow and his followers. The theory of elective affinity, while very attractive, has not yet received the experimental confirmation necessary to its general acceptance.

The occurrence of epidemics apparently due to a single strain of organism of this group, while very rare, has been observed. That the strain in question arose as above indicated is another question. The theoretical analogy between the passage of a strain, already an inhabitant of the bodies of a species, through other individuals of the same species, and the laboratory process of enhancing the virulence of an organism obtained from human sources or from old cultures on artificial media, by passage through a different and susceptible animal, is obviously not complete. In the one case the environment remains substantially the same, in the other the change of host involves a radical change in the environment, and the adaptation to the new conditions and the increase in virulence appear to proceed *pari pasu*. A time finally comes when further development along these lines is impossible.

Further, in the greater number of such epidemics there has been found no evidence supporting the idea of a distinct invading strain. In any one outbreak the disease is seldom in all cases, or even preponderatingly, apparently due to the same organism. In the pneumonia associated with measles in the Army camps in the fall of 1917, streptococci and the mouth types of pneumococci were found in varying proportions, often associated. Other bacteria, including the bacillus of Pfeiffer were often found in these cases. There is no evidence tending to show that the streptococci so frequently found in these cases were all of one strain. Indeed cultural studies in some

camps showed distinct diversity in the strains isolated. The general clinical and pathological character of these pneumonias, however, remained very much the same, irrespective of minor differences due to the varying character of the invading bacteria. Thus the simultaneous development of large numbers of cases of pneumonia of similar type, due apparently to a diversity of infecting organisms, points logically to a common cause which directed the course of the ensuing pneumonia. In the epidemic cited this was of course measles. Later, in the spring of 1918, a wave of similar pneumonias, characterized by the same diverse bacteriology invaded the camps. It would appear logical to attribute this outbreak also to some common infecting agent rather than to a general reduction of individual resistance. The common cause in this case is to be found in the concurrent appearance of the first recognized wave of the influenza pandemic, which appeared in the camps in March and April, 1918. By combining the records of twenty camps which showed a well marked rise in the incidence of respiratory disease at this time in such away as to make the peak months of the various camps coincide, we obtain Fig. 1, drawn to a logarithmic scale which shows without question the relation between the spring epidemic of influenza and the accompanying pneumonia. In some camps there was a still earlier outbreak of respiratory disease, which was frequently diagnosed influenza, and which was also accompanied by pneumonia, as study of the individual camp records shows. The bacterial findings in these early and mild outbreaks of epidemic respiratory disease, like those in the more serious fall outbreak, and like those of the pneumonias accompanying all the waves, were consistently diverse, and were limited to the facultative group of pathogens.

The object here sought is to call renewed attention to the distinction between obligate and facultative pathogenic organisms, and to emphasize the fact that organisms of the facultative group are essentially secondary invaders. That the facultative pathogens are usually secondary invaders will be readily admitted. That it is possible that they are practically always so, at least in epidemic outbreaks, is the point which it is now desired to advance. If this hypothesis should prove on further study to have a firm basis in fact, its general value in epidemiological and etiological study may readily be recognized.

This value is especially evident in the case of the respiratory infections. Here we have not only epidemic outbreaks but regular seasonal waves of disease characterized by infection by the various members of the so-called respiratory group of bacteria which with few exceptions may be definitely placed in the group of facultative pathogens. If our hypothesis is well founded, it is evident that our first objective must be the discovery of the primary cause of these diseases before we can hope to obtain results in prevention and cure. By analogy with several known diseases supported by some experimental evidence it appears permissible to infer the possibility that this primary cause will prove to be a hitherto unknown infecting organism.

CARDIOVASCULAR SYPHILIS

BY BURTON PETER THOM, M.D.

Visiting Syphilologist to the Hospitals of the Department of Correction, Welfare Island, New York City

---

That syphilis attacks the heart and vessels was known to Severinus, the disciple of the great Paracelsus, who lived four hundred years ago. Ambrose Paré, the first of the modern surgeons, recognized syphilis as a cause of aneurysm. More than a century later Astruc and Morgagni wrote of syphilis of the heart and arteries. It was not, however, until the middle of the eighteenth century that cardiac syphilis was described with any degree of accuracy by the Italian clinician, Giovanni Maria Lancisi. Although he wrote more than a century and a half ago his clinical descriptions can still be read with interest and with profit. In the middle of the last century Ricord published an accurate description of cardiac gumma, and ten years later the masterly account of Lancereaux established beyond question of a doubt syphilitic cardiopathies as distinct clinical entities. From that time until the discovery of the *Treponema pallidum* by Schaudinn and Hoffman in 1905—a period of more than forty years—the best monographs on syphilis of the heart were those written by Fagge, Mracek, and the pathologist, Kundrat. Since then the literature has become, to say the least, voluminous, so that to even give a partial list of those whose writings are authoritative would be impossible here.

Despite the fact that syphilis of the heart and vessels had been known so long, its importance as a factor in the causation of the various cardiopathies was generally overlooked. To a certain extent this is true even now; although the advent of the Wassermann reaction as a means of diagnosis has produced a revolutionary change in our former conceptions of syphilis as a basic factor in a large number of other syndromes which were not considered to be related to it. The newer clinical pathology of syphilis is therefore much more embracing than the old. Especially is this true of those diseases which involve the circulatory apparatus. Leishman long ago showed that the

Treponema pallidum has a special predilection for the blood-vessels, and the brilliant work of Warthin has demonstrated how profoundly the cardiac musculature and the arterial coats are affected by the parasite of syphilis. Brown and Pearce of the Rockefeller Institute have shown that the invasion of the treponema is much more rapid than was formerly supposed—that the organism is generalized throughout the body within a few hours after passing through the solution of continuity which affords it a portal of entry. In this rapid dissemination of the infecting agent no tissue is exempt. It is undoubtedly then, at the very beginning of the infection, that the heart and vessels are attacked. Simultaneous with this involvement of the vessel walls which the treponema approach through the vasa vasorum there are undoubtedly changes in the adrenals caused by the irritative presence of the treponema which give rise to an increase of the *pressor* substances in the blood which is the primary cause of the setting of the tonus which later is maintained by the cellular proliferation of the intimal and medial coats. This is the pathogenesis of arterial hypertension. I shall later discuss it more in detail.

Syphilitic disease of the heart may be manifest in the pericardium, the myocardium or the endocardium. It may develop in either or all of these within a few months of the appearance of the chancre or after many years—for it must be thoroughly understood that cardiac syphilis is by no means always the tertiary form of the disease. Early clinical signs of cardiac syphilis have been observed by such competent observers as Brooks, Fordyce, and Moore.

When the lining and enveloping membranes of the heart are affected there is always more or less involvement of the myocardium. This explains why in so many old syphilitics evidences of myocardial degeneration are so frequently found. It also explains why in not a few such patients myocarditis is present without signs of severe valvular disease. Histologic evidence of this involvement has been recently brought out by the investigation of Van Der Stricht and Todd who have shown that the longitudinal cleavage of the cells of Purkinjé are much more apparent in the syphilitic than in the normal heart. This cleavage is due to a hypertrophy of the interstitial connective tissue. It would seem to me that this degenerative process going on in the cardiac musculature, which the two workers of the Johns

Hopkins Hospital have observed, is somewhat analogous to the so-called fragmentation of the myocardium, the "myocardite fragmentaire" of the French.

Specific examples of syphilitic pericarditis are not often mentioned in the literature. Brooks has reported two cases. Stobie has described a case with effusion into the pericardial sac occurring as a tertiary manifestation. The signs and symptoms of syphilitic pericarditis do not differ from those when this cardiopathy arises from some other cause. When occurring in the early stage of the disease there are nearly always other concomitant evidences of the affection which materially help in pointing to its luetic origin. When present late in the disease these signs may not be so patent, but if occurring idiopathically as it were, that is when other causes can be absolutely ruled out the possibility of syphilis must always be considered.

Syphilis may give rise to endocarditis either acute or chronic. The acute form is rare, but a number of observers claim to have encountered it and there is no pathologic reason why it cannot occur. As all consultants are aware, endocarditis, arising from any cause, frequently goes unrecognized. This is especially true of the subacute ambulatory cases, in which the damage to the valves may be irreparable before it is discovered. It is in this form in which syphilitic endocarditis is particularly prone to occur. It has been stated that syphilitic endocarditis is most frequent at the apex of the left ventricle or at the base of the heart close to the aortic orifice. I am convinced that many cases of aortic disease have their origin here instead of in the walls of the vessel itself.

I have already made brief mention of syphilis as a frequent cause of myocarditis. Also I have stated that modern research has conclusively proven that the invasion of the cardiac musculature occurs very early in the disease. Warthin has found the *Treponema pallidum* in the heart muscle at necropsy in subjects whose Wassermann reaction was negative before death. Pathologists, if not clinicians, are aware that syphilis of the heart is more frequent than is usually supposed. The *active* presence of the treponema in the cardiac musculature is a possibility that must never be forgotten. It is possible, in fact it often happens, that they exist in a dormant state for many years and their presence only is discovered at necropsy; but it

can never be foretold when there will be a relighting of the smouldering fire as it were. I am more and more convinced from an experience that is somewhat extensive that many cases of myocarditis developing suddenly in middle life or in the fifth decade of life in syphilitics, whose only somatic evidence of the disease is a positive Wassermann reaction, is due to either the prolonged activity or to the suddenly awakened activity of treponemata that have existed in the cardiac musculature for many years. This has been well brought out by Stokes of the Mayo Clinic who has pointed out that in all patients with a persistently positive serum reaction, aside from a search for lesions elsewhere, a careful examination of the cardiovascular apparatus should be made because it may be that the existence of the treponema in the myocardium may be from whence come the lipoids which cause a positive reaction in the serum. It is because of these facts that I am in full accord with Dicker that all syphilitics, unless thoroughly treated, should also be regarded as potential cardiopathics.

Various writers have given certain signs and symptoms as pathognomonic of cardiac syphilis. There are no pathognomoic signs and symptoms of cardiac syphilis. There are signs and symptoms which are strongly indicative of such but it must be remembered that these signs and symptoms may all be present in cardiopathies arising from causes other than syphilis. It must also not be forgotten that a syphilitic may have been cardiopath before he contracted the disease and his cardiac syndrome while accompanied by a positive Wassermann reaction may be independent of the syphilitic infection. Or, it may be that the cardiac disease has been acquired independently of syphilis from a pyogenic focus somewhere in the body, as for instance pyorrhœa alveolaris, a chronically inflamed appendix, chronic prostatitis, chronic gonorrhœa—a more frequent cause than is usually supposed. Because the patient has syphilis he is not exempt from any of these. Before cardiac syphilis is absolutely diagnosed these and all other factors, present and past, must be eliminated. Yet when they are eliminated it will be surprising how often syhilis will be found to be the disturbing element.

As I have already stated there are no pathognomonic signs of cardiac syphilis yet there are certain signs and symptoms which are strongly indicative of it in so far as the heart is involved. These

signs and symptoms when present should cause syphilis to be suspected. Before doing so, however, I shall quote the words of Semola written long ago, because the rule he lays down is a most excellent rule to go by especially since we have the diagnostic advantage of the Wassermann reaction which he did not. "If a patient has unquestionably had syphilis, presents himself with symptoms of a persistent arrhythmia, which refuses to yield to hygienic or pharmaceutical remedies, the physician must conclude that a syphilitic process exists, and must order specific treatment for the patient even if at the time there are no symptoms which furnish ocular proof of the presence of constitutional syphilis." A symptom of great importance in syphilitic cardiac disease is pain. Any cardiopath who along with his other symptoms suffers with pain should always be examined for syphilis. Leredde claims that morning arrhythmia accompanying either tachycardia or bradycardia is significant of syphilitic cardiac disease. While this sign may have been present in the series studied by Leredde I am not inclined to accept it as in any way pathognomonic of cardiac syphilis. Patients with cardiac syphilis not infrequently complain of psychic depression and are frequently melancholy and have a fear of impending death but this mental state is by no means always present. For the sake of emphasis therefore I repeat: there are no pathognomonic signs and symptoms of syphilis as it attacks the heart, with the possible exception of precordial pain. There are, however, certain pathologic processes of the heart which when present point strongly—very strongly—to syphilis. These are chronic myocarditis occurring in comparatively young subjects in which other known causes can be ruled out; the sudden development of myocarditis—the *myocardite deshabitées* of Lenoble—in which the symptoms improve and then recur and in which pain is a prominent symptom; aortic disease, manifest at the valves either as an insufficiency or as a stenosis, as a mesaortitis or as an aneurysm; high blood-pressure in a person under forty-five years of age.

In addition to these there are cardiac abnormalities of considerable interest which are the result of lesions of the central nervous system which in a large proportion of cases can be traced to syphilis as the exciting cause. That syphilis early and persistently invades the central nervous system is well known. The symptoms this invasion gives

rise to may be said to include every syndrome known to neurology. Not a few of these include in their category of symptoms those which are referred to the cardiovascular apparatus. As a rule these are those which refer to the rhythm of the heart and for that reason as has been stated by Barker all cardiac arrhythmias should arouse a suspicion of syphilis—especially syphilis of the nervous system. The high governors of the heart are for the most part contained within the medulla oblongata at the base of the brain which when involved as it nearly always is in syphilitic basal meningitis gives rise to arrhythmias such as irregularity, acceleration or retardation of the heart beat and the pulse. The ganglia in the heart itself are also not infrequently involved by gummatous infiltration and the symptoms known as paroxysmal tachycardia or "galloping heart," or its opposite of heart block, may be caused thereby. Bradycardia or abnormal slowness of the heart beat and pulse is frequently observed in cerebral disease—not necessarily syphilitic, but unless these other causes can be ruled out, including the toxæmias of lead and other poisons, syphilis should always be thought of in this condition. Bradycardia is caused by irritation of the vagus either direct or indirect. This is especially prone to occur in infiltrative gummatous deposits involving the pons varolii or medulla oblongata. Or, the slowing of the heart's action may be due to degenerative changes in the heart muscle which, while is some instances due to other causes is frequently caused by syphilis. Again, the slowing of the heart's action, with the symptoms it connotes—breathlessness, weakness and attacks of syncope—may be due to lesions of the cardiac ganglia. If the bradycardia can be removed by an injection of atropine it can be assumed that the cause is to be found in the vagus; if it cannot be removed by an injection of atropine it can be assumed that the cause is in either the heart muscle or the intrinsic ganglia. In progressive bulbar paralysis which is frequently of syphilitic origin, disturbances of the circulation and respiration are observed. There is dyspnœa and tachycardia—the pulse often 130 or more.

The tumultuous action of the heart observed in the syndrome known as Graves' disease or Basedow's disease is pathognomonic. In a considerable number of cases syphilis is the underlying factor. A persistently rapid pulse, that is a pulse that is not influenced by

several weeks rest in bed, should always arouse suspicion of this syndrome and incidentally of syphilis as a possible cause.

Long ago Rhomberg called attention to the frequency of cardiac disease in tabes and paresis. Whether the cardiac lesion develops synchronously with the nervous lesion or develops before or after it is established it is impossible to say. Every case of tabes or paresis, whether incipient or moderately advanced should also be examined for possible cardiac complications. In a suprisingly large number the heart will be found to be involved as well as the nervous system. In tabes, crises in the cardiac region of the vagus nerve sometimes occur. The symptoms very closely simulated an attack of angina pectoris.

As I have already stated, and which is becoming more and more widely known as a better idea of what constitutional syphilis really means as a factor of supreme importance in the causation of the various degenerative visceropathies, the *Treponema pallidum* early singles out the vascular apparatus for its particular attack. The best known as well as the most formidable of the syndromes arising from syphilis of the blood-vessels is aneurysm of the aorta. I am in accord with Hubert who asserts that syphilitic aortitis comprises seventy per cent. of all syphilitic viceropathies occurring within the thorax. Reid noted syphilitic aortic disease in 5.5 per cent. of all necropsies at the Massachusetts General Hospital. Similar findings were obtained by Pulay in a German dermatologic clinic. Feldman, Abramow and others, both here and abroad, have published reports which are in accord with those mentioned. As long ago as 1866, Wagner described the macroscopic appearance of syphilitic aortitis. It was not, however, until the careful studies of Dohle in 1888 and those of Heller somewhat later that the direct relationship between syphilis and aortic disease was definitely established. Although, in passing I would say that Ambrose Paré must undoubtedly have realized it, if I interpret his writings correctly. The clinical descriptions of Huchard, Dieulafoy, Gallavardin and Fournier have not been improved upon by any that have appeared subsequently. The pathology of the syphilitic aorta as described by Warthin will, I believe, remain a classic; although it is only fair to say that similar findings were noted by Schmorl and also by Reuter. The clinical observations

of Allbutt, Bruce, Schwarz, Breitmann, Goldschneider, and Longcope have practically completed our knowledge of this desperate syndrome.

There are those, and they are not all syphilologists, who affirm that aortitis and aneurysm its logical sequence are invariably due to syphilis. I do not believe this. Brown of the Mayo Clinic has discussed the non-syphilitic forms of aortitis at length and the cases cited by him are ample evidence that syphilis is not the sole cause of aortitis. The same conclusions were also reached by Poyntin, Klotz and others. The most recent study of non-syphilitic aortitis has been made by Goynaroff. He endeavored to ascertain if in every instance of aortitis syphilis should be regarded as the sole and only cause. His conclusions were that syphilis could not be so regarded. While I am of the opinion that causes other than syphilis can give rise to aortitis, syphilis is by far the most important etiological factor. For that reason the presence of this lesion should always arouse a strong presumption of syphilis.

The syndrome known as angina pectoris we now know to be due to syphilis in almost every instance; so much so that every case of heart pain should at once cause a searching inquiry as to the existence of this infection. It was formerly taught and believed, and is yet to a large extent by the profession, that angina pectoris was due to a spasm of the coronary arteries, which were also more or less extensively sclerosed. While sclerosis of the coronary arteries undoubtedly occurs as a manifestation of cardiovascular syphilis I am in accord with Allbutt that the sclerotic involvement of these arteries of the heart is not the sole cause of this agonizing and formidable syndrome. It is possible—it is quite possible—that a suddenly occurring spasm of the narrowed and atheromatous vessels may be a participating factor in these fulgurant attacks of heart pain. I am convinced however from abundant clinical testimony as well as from equally abundant testimony obtained at necropsy that it is not the only cause, and in some instances sclerosis of the coronary arteries may exist without ever being manifest by heart pain. Without completely assenting to the belief that angina pectoris is not due to coronary involvement Pal states that it can occur in the absence of any changes in the coronary arteries. Pal also is of the opinion that anginal attacks can occur without arterial hypertension. This is in accord with the findings of

Lundsgaard, who reported a case of typical angina in which the blood-pressure was normal, the pulse showed no irregularities and the other physical signs which would be supposed to be present were not observed. The X-ray, however, showed a beginning aneurysm.

Allbutt believes that the pain in angina is due entirely to a sudden stretching of the aorta caused by the hyperpiesis or a sudden raising of the blood-pressure caused in most instances by physical or mental strain. In not a few instances, the immediate history previous to the attack as given by the patient seems to confirm this. While admitting the probability of Allbutt's hypothesis in very many instances I am not in accord with him in dismissing entirely the theory of spasm of the sclerosed coronary arteries as a potent factor in causing anginal attacks. Nor do I agree with him that the "old ischemic theory is evidently falling out of favor." Although Allbutt does not, I still incline to the correctness of Danielopolo's belief in the "disequilibrium between heart work and coronary circulation." I believe with Pick and Hecht that real stenocardial attacks occur from involvement of the coronary arteries.

Aortic disease, and by that I also include aneurysm, is usually insidious in its onset. Not infrequently it is far advanced before it is detected. It may even only be discovered at necropsy. The symptoms of which the patient complains and cause him to seek medical advice are pain—nearly always substernal, dyspnœa, palpitation and tachycardia. The pain is almost invariably increased upon exertion. In many instances it radiates down the left arm. This arm pain is often the pain of which the patient most complains. This left arm pain is, in my opinion, frequently caused by an arteritis of the subclavian artery, which in some instances is the artery alone affected. Nothnagel described a *forme fruste* angina which he designated *angina pectoris vasomotoria*. In this condition there are attacks resembling somewhat true angina but which do not originate in a primary lesion of the aorta or coronary arteries. It is due to a widespread arterial spasm with secondary symptoms of stenocardia. These patients complain of peculiar localized paresthesias, especially in the hands and feet, sensations of cold and numbness with precordial distress and pain. The heart beats slowly, strongly and regularly. The patient's body may be covered with a cold sweat. Like true

angina these attacks are frequently brought on by exposure, particularly if the patient has been out in a high wind. In almost every instance there is evidence of arterial hypertension. It is not possible here to go into detail as to the pathogenesis of this syndrome. I shall only say that I believe it is brought about by a sudden disturbance in the secretory activity of the adrenals which causes them to throw an increased amount of *pressor* substances into the blood. The dysfunction of these glands as the primary factor in inaugurating the series of processes which ultimately result in arteriosclerosis has been, I believe, overlooked by pathologists and clinicians.

There are certain features of angina pectoris which are worthy of consideration but which are often not mentioned either in text-books or in the literature which from time to time appears in the journals. Quite recently these have been well brought out by Levine. I shall give them here although with some of the conclusions contained in his paper I am not in accord.

Angina pectoris is more frequent in males than in females, and it is most frequently observed in those who are robust and strong. It is more frequently encountered in those whose blood-pressure registers above the average for their age—in other words, in those who have arterial hypertension. Examination of the heart is often negative. In Levine's series forty-seven out of a total of one hundred and three showed no murmurs. The cardiac rhythm is nearly always regular; extra systoles are only occasionally encountered. Levine notes the infrequency of angina pectoris in those with auricular fibrillation. He says: "Patients with auricular fibrillation are not likely to have or to develop angina pectoris; and, *vice versa,* those suffering from angina do not develop auricular fibrillation."

Levine further makes a distinction between angina pectoris and a coronary infarct which is absolutely correct in detail. This difference is often of supreme importance, and as it has been ably described by him I can do no better than to repeat his words. "It is very important to distinguish attacks of cardiac infarction from those of ordinary angina pectoris, for where the prognosis of the former is generally only days, that of the latter may be years. The patient having cardiac infarction shows the picture of shock and is cyanosed; the pain may last many days, and is not relieved by nitrites, or even

at times by morphine; the pulse is likely to be a little rapid and small; the systolic pressure falls sometimes as low as 90 or 80 millimetres; râles develop at the bases of the lungs, and the liver may become engorged and tender. A leucocytosis of 20,000 or more frequently develops." As a rule these patients die; occasionally they may recover.

In some instances the abdominal aorta may become diseased, in the event of which we get the rather rare and always confusing syndrome of angina abdominis. Here the pain, which may be excruciating, may be confined to the abdominal cavity with occasional radiation down the legs. This condition has been noted by Allbutt and also by Stolkind, who observed it in nine cases out of 132. Goodman of Philadelphia has also reported a case. The elaborate description by Pal has given this syndrome a distinct place among the disease entities of the cardiovascular system. Not infrequently aortitis of the abdominal aorta has been mistakenly diagnosed for some one of the various conditions designated by surgeons as "acute abdomen." Mistakes in diagnosis have even caused operative interference. It is quite possible, in my opinion, that abdominal aortitis, in view of the frequent involvement of the vascular apparatus in tabes, is the cause in some instances at least, of the "gastric crises" which sometimes occur in this disease.

A form of abdominal angina has been described by Ortner, who designates it as *dyspragia angiosclerotica intermittens*. There are attacks of abdominal pain frequently associated with gaseous distention. These attacks are brought about by an intermittent claudication of the mesenteric arteries, similar to those which sometimes occur in the legs. Cases which have come to necropsy invariably show a sclerosis of the mesenteric arterial supply. It is also quite possible, in my opinion, that the "gastric crises" of tabes may be due to this cause in some instances as well as to the involvement of the dorsal nerves.

Syphilitic disease of the aorta is found most frequently in patients under fifty years of age. The causes which act to produce this lesion other than syphilis, except acute infections such as diphtheria and sepsis, usually do not show until after the fifth decade of life. For that reason aortic involvement under fifty years of age

should at once arouse a strong suspicion of syphilis. In the series studied by Longcope over one-half were under forty years of age and nearly one-third were under thirty years of age. This is in accord with my own experience. While it can be assumed that aortitis is nearly always a tertiary manifestation of syphilis, yet cases have been recorded which developed within two years of the appearance of the chancre, which in point of time at least must be considered as within the secondary period. According to Longcope the time required for the lesion to evolute to the symptomatic stage is somewhat over fifteen years. The statistics gathered by Grossman as to the age incidence of chancre is approximately twenty-five years. Add fifteen years to this and the time of the appearance of syphilitic cardiovascular disease would be considerably less than forty-five years, which clinicians generally agree is the age when this form of syphilis is most likely to become apparent.

The fibrous and at times calcareous transformation of the arterial coats or tunics due to the aging of the organism differs but slightly, if at all, from the sclerosis due to pathologic causes. This senile sclerosis and the sclerosis which is pathologic are both of slow development; only the pathologic is more rapid than the senile. For that reason pathologic changes in the arteries bring about senile changes sooner than when the changes are due to the gradual degenerative transformation of increasing age. In both instances the sclerosis is the result of essentially the same cause, that is, irritation. This irritation may be from within; that is by substances in the blood stream which are various and at present not possible to isolate with anything like absolute certainty. Modern pathology has taught us where to look for some of these sources of irritation—these septic foci which slowly poison the blood and thus the complicated enveloping apparatus through which it courses—pus pockets at the roots of the teeth, the prostate, the appendix, and joints. Our increased knowledge of the normal and pathologic physiology of the glands of internal secretion—the endocrines—when perverted in their function are often remote if not direct causes in many instances of arteriosclerosis.

When syphilitic infection occurs, it is only a question of a few days at the most, as Brown and Pearce of the Rockefeller Institute

have conclusively shown, that the spirochetosis becomes generalized. There is not a tissue or organ of the body that is not invaded, but there is an undoubted predilection for the walls of the blood-vessels (Leishman). Disseminated throughout the body practically from the beginning of the infection the treponemata quickly inaugurate the changes in the adrenals and the vessel walls which in time lead to the more or less generalized arteriosclerosis and the high blood-pressure which this condition connotes.

The treponemata attack the three coats of the arteries—the adventitia, the media and the intima. This attack is by way of the vasa vasorum, which are frequently obliterated, and the lymph spaces. The irritation they excite causes a proliferation—a purely defensive process—of plasma cells and lymphoid cells and multi-nucleated giant cells. This proliferation may be circumscribed and thus partake of the character of a gumma, but more frequently it is diffused throughout the media and intima and, as in all syphilitic inflammation, this cellular infiltration later undergoes fibrous transformation which naturally distorts, contracts and hardens the artery. The part the adrenals play in the production of arteriosclerosis I have discussed elsewhere.[1]

While I am aware that some authorities are not in accord with me that syphilis is the most important single factor in causing arteriosclerosis, from the facts as I have observed them I cannot come to any other conclusion.

The signs and symptoms of this condition are too well known to be further discussed here. I can only say that the presence of this syndrome in persons under forty-five years of age is, in my opinion, strongly suggestive of syphilis. It may be, and often is, the only symptom of the disease except a positive Wassermann reaction in the blood, which these patients almost invariably have.

In the early part of the present year (issue of January 18, 1922) there appeared in the *New York Medical Journal* a most illuminating monograph entitled " Syphilis of the Medium and Smaller Arteries " by Aldred Scott Warthin. Simultaneously with it (issue of January 21, 1922) a short study of my own entitled " Syphilis and High Blood-

[1] " Syphilis and High Blood-pressure," by Burton Peter Thom, M.D., *Medical Record*, January 21, 1922.

pressure" appeared in the *New York Medical Record*. In these two theses Warthin and I reached the same conclusions. He by pathologic research from necropsy material and I by clinical observation from material in my service in the prison hospitals of the Department of Correction of New York City. Warthin observed a more or less generalized arteriosclerosis in 90 per cent. of the cases coming to autopsy of syphilis in the latent or tertiary stage. The major portion of the material autopsied by Warthin was of young or middle-aged subjects and therefore the arteriosclerosis was premature in point of the age of the individual. He particularly observed this sclerotic condition in the renal, splenic, mesenteric, coronary and cerebral arteries. It is needless to indicate that sclerosis of these vessels connotes more or less degeneration of the viscera supplied. A natural corollary to this is that syphilis above all other diseases is concerned in the degenerative visceropathies which shorten life and bring about premature senility.

My study comprises fifty cases, twenty-five men and twenty-five women, selected at random and representing a cross-section of the population of the most cosmopolitan prison on the western continent. Manometric studies showed that 58 per cent. of these patients had a blood-pressure considerably above normal. While the number included in this study was not large a percentage as high as this cannot possibly be due to chance or coincidence. I am in complete accord with Warthin that the percentage of syphilitics with arteriosclerosis as compared with non-syphilitic is twenty-five times greater. My own clinical experience has convinced me that this statement is not at all exaggerated.

For that reason every syphilitic—and this includes those who are seemingly in the best of health and whose only sign of the disease is a positive Wassermann reaction in the blood—should invariably be subjected to a careful examination of the heart and vessels. By thus early searching out cardiac and vascular changes, it is possible in not a few instances to prevent them from progressing and thus hold them in abeyance for many years. For I am in accord with Vedsmand and with Thomas that many cases of apoplexy occurring late in life are frequently preceded by a remote syphilis.

The pathologic changes involving the coats of the arteries which

are proliferative and which cause a narrowing of the lumen of the vessel frequently advance to the ultimate conclusion of such processes and obliterate the lumen completely. That this occurs in the smaller arteries is well known. Huebner's description of this obliterative endarteritis of the cerebral arteries has become a classic although it was written nearly fifty years ago. The syndrome known as intermittent claudication is another well-known example. It is not so well known, however, that syphilitic arteritis sometimes causes complete occlusion of the arteries of large size. *Arteritis syphilitica obliterans* was first described by John Davy, a brother of the great English physicist, Sir Humphry Davy, more than eighty years ago. Many years later Jonathan Hutchinson described obliteration of the femoral artery and of the left carotid artery. In 1889, Hutchinson in his Bradshaw lecture referred to "two remarkable cases, one recorded by Sir William Gull and one by Sir William Savory, in which the large arteries of the head and neck were extensively occluded." Coming nearer to the present, similar occlusions of vessels of large size have been reported by Thompson, Snow, Winiwarter and Gould.

In 1915, Darling and Clark wrote the best description of *arteritis syphilitica obliterans* that has appeared within recent years. They describe a number of cases which they encountered in their work in the Board of Health Laboratories at Ancon, Canal Zone. The illustrations accompanying their text show most vividly the obliterative process in the vessels affected; which in the cases described by them was most frequently the left common carotid. The pathology as detailed by Darling and Clark consists in an intense proliferation of cells of the intima. The media and adventitia also shared in this process. The distinctive feature being that a proliferative thromboarteritis occurred only at the distal end of the proliferative change in the intimal coat.

In obliteration of vessels of large size the signs and symptoms must perforce depend entirely upon the extent and facility wherewith is set up a compensatory collateral circulation. The obliteration must of necessity be slow and with it the collateral circulation must also proceed apace, although it cannot be expected to equal the normal. As Darling and Clark emphasize, and with them I am in full accord, this

obliteration of important arterial trunks not infrequently goes unrecognized, or else the signs and symptoms arising therefrom are assigned to some other cause. It is therefore quite possible that many obscure cerebral, neural and visceral diseases are due in appreciable instances to unsuspected obliteration of one or more large vessels originating from syphilis. In carotid occlusion Kussmaul, Guthrie and Mayor, and Hunt have noted the presence of unilateral headache, vertigo, epileptiform seizures, pallor of the optic disc and atrophy of the optic nerve and various forms of hemiplegia.

Syphilis as the cause of congenital cardiovascular disease has not, in my opinion, been sufficiently studied. It undoubtedly offers a fertile field for research. I would class congenital cardiovascular lesions as belonging to the order of dystrophies. In not a few instances I am convinced that their beginning was *in utero*. It is thus that they appear not as active lesions but as aberrancies such as congenital stenosis of the pulmonary artery. The condition known as hypoarterialism in which the heart and vessels are of small size is, in my opinion, a dystrophy frequently due to congenital syphilis. These patients all show a tendency toward tubercular disease of the lungs and this is one of the reasons why perhaps, so many congenital syphilitics eventually succumb to pulmonary tuberculosis. The condition known as "Addisonism" or hypoadrenalism which is attended with asthenia and a low pressure pulse is also in many instances a masked form of congenital syphilis or perhaps it would be more in accord with the facts to say the result of congenital syphilis.

Aortitis occurring in the course of congenital syphilis has been observed by Biermann and also by Wentworth. It is therefore quite possible that other cardiopathies appearing in children or young adults in whom rheumatism, diphtheria, or the exanthemata of childhood can be ruled out, may be due to congenital syphilis. Their presence in the absence of the conditions named should at least arouse suspicion of this cause.

The treatment of cardiovascular syphilis is the treatment of syphilis generally. There are certain reservations, however, which apply to the treatment of this form of syphilis which should be carried out in order to obtain the maximum benefit of the powerful specifics at our command. These reservations I shall briefly enumerate.

It is the belief held by many that syphilitic lesions are always easy to eradicate. This in a large measure is true, but there is a certain modicum of that measure in which it is not true. The ease with which the lesions of syphilis can be eradicated depends entirely upon their pathologic age. If they are recent, under the influence of organic arsenic, mercury and iodine they can be made to melt away like snow before the noonday's sun. But if the process has existed long enough for the new cell proliferation of the active phase of the infection to have become transformed into fibrous tissue —as this cellular infiltration invariably becomes transformed—no amount of treatment can restore, or cause to be rejuvenated as it were, that which has been destroyed. In such instances while the serum may show a positive Wassermann reaction and the patient therefore is syphilitic, the active process, at least in as much as it affects the cardiovascular apparatus, may have long before spent itself. Under such circumstances we are dealing wholly with end results—the damage has been done and no amount of treatment, no matter how skilfully given can undo this damage. For that reason syphilitic cardiovascular disease if it has existed for too long a time cannot in the very nature of things be very materially helped by treatment. The hardened arteries cannot have their former resilience restored to them by a few injections of arsphenamin, or even by many; the degenerated myocardium cannot be transformed back to healthy heart muscle; the weakened and dilated walls of an aneurysm cannot be made whole and strong again. In such cases, while antisyphilitic treatment should be given with the possible object of giving the patient the benefit of any doubt, if there is no response in the way of the rapid amelioration of the symptoms it should not be continued, as it may do more harm than good. As is to be inferred this particularly applies to patients sixty years of age or over. In these patients if a preliminary course of arsphenamin injections—say three at intervals of a week or ten days—shows no improvement, it is useless to continue and may do harm.

Considerable has been written concerning the danger of the so-called Jarisch-Herxheimer reaction in patients with aortitis or sclerosed coronary arteries in whom the anginal syndrome is pro-

nounced. It is usually stated that such patients should receive only the minimum dose of arsphenamin. I am not altogether in accord with this. In my opinion the danger of the Jarisch-Herxheimer reaction in these cases is somewhat exaggerated. Colloidoclasic shock, or as it is more frequently and—I might add—incorrectly termed anaphylaxis, is a much more imminent danger This, however, can be prevented by preceding the injection of arsphenamin with 60 c.c. of a 2 per cent. solution of either sodium bicarbonate or sodium hyposulphite solution. If, however, the Jarisch-Hexheimer reaction is feared its appearance can be reduced to the lowest possible minimum of chance by the intravenous injection of colloidal iodine daily for several days before administering the arsphenamin. If for any reason this is not possible the oral administration of not less than twenty minims of a 100 per cent. solution of sodium iodid t.i.d. well diluted, *i.e.,* in a tumbler of water, will also prevent this contingency. I am firmly convinced of the efficacy of sodium iodid as a preliminary to arsphenamin administration, especially in cardiovascular disease. While it has no spirillocidal effect it undoubtedly causes absorption of new cell formation and in that way eliminates morbid products. The action of arsphenamin is distinctly spirillocidal and it possesses no other power. In a broad sense it may be said that one destroys the cause and the other removes the debris which is the result of the cause.

In my opinion, neoarsphenamin should always be given the preference over arsphenamin. Not only is it infinitely less liable to cause colloidoclasis—as Schamberg has shown it is the least apt to cause hemolysis—but it can be given in such a small amount of water that there is absolutely no stress put upon the heart when it is thrown into the circulation. This is not so with arsphenamin, which requires a dilution of 200 c.c. for 0.6 gram, whereas 0.9 gram of neosalvarsan can be given in 30 c.c. of water. It is needless for me to dilate upon the advantage of this difference in the amount of fluid injected into a circulation motivated perhaps by a very much crippled heart. Arsphenamin should not be given if there is an advanced grade of myocarditis. Neoarsphenamin should invariably be given the preference. The same is true of aneurysm. It is well known to

syphilologists that organic arsenic when given intravenously causes for the time being a decided fall in the blood-pressure, for that reason in all cardiopathies attended with hypoarterial tension the arsenical should always be preceded by an intramuscular injection of adrenalin. Again it can be assumed that in the majority of cardiopathies there is frequently a concomitant nephritis, usually of the interstitial type, and as mercury is decidedly nephrotoxic this ancient antiluetic remedy should be given with caution. I will go further. If nephritis is present mercury should not be given at all. It must also be remembered that in cardiac disease the liver is often congested and a certain degree of cirrhosis may be present—it nearly always is if the cardiac disease has existed for a long time. Organic arsenic exerts, as Schamberg and others have conclusively shown, a powerful and long continued toxic effect on the liver. Therefore, if the liver functions are impaired extreme caution must be exercised in giving arsphenamin or any of its congeners. In order that the least stress may be put upon the liver when organic arsenic is given the patient should be put upon a strict carbohydrate diet for several days preceding the administration of the arsenic and for several days thereafter. I make it a practice in giving organic arsenic to have the patient live on a skim milk diet for a day or two before and after giving arsphenamin, or rather neoarsphenamin, for I have long since given up using the older drug.

If the patient is advanced in years, organic arsenic rather than mercury should be the drug of choice, unless as I have already stated the liver is involved. Aside from antisyphilitic treatment syphilitic cardiovascular disease should be treated along the usual lines laid down for the treatment of such conditions as they arise from any other cause. Rest, digitalis, strophanthus, nitroglycerin, in some instances restriction of fluid intake, are as necessary here as they are in all cardiac diseases no matter what their cause may be.

The prognosis of any syphilitic cardiopathy is dependent entirely upon the extent of the damage done. In not a few instances this damage is more apparent than real and it is often marvellous how seemingly grave and hopeless lesions will respond to careful and intelligent treatment. This should always be borne in mind, and wherever possible the patient should be given the benefit of the doubt

and treatment instituted. The results which are often achieved will make it well worth while. As McLachlan has shown and I have seen from personal observation even such a desperate process as aortic aneurysm can be stayed and the patient returned to a life of usefulness.

In conclusion, I wish to emphasize that cardiovascular syphilis is more frequent than is supposed. Also that every patient with syphilis should be considered a potential cardiopath and should be observed and treated accordingly. Also in treating syphilis of the heart and vessels the treatment should be gauged to meet the case; not the case to meet the treatment. Also, all other things being equal the prognosis of cardiac disease of syphilitic origin is immeasurably better than when it is due to some other cause.

DIPHTHERIA: EPIDEMIOLOGY; INDIVIDUAL SUSCEPTIBILITY AND PROPHYLAXIS, WITH SPECIAL REFERENCE TO THE SCHICK TEST; TREATMENT AND MANAGEMENT OF EPIDEMICS *

By A. PARKER HITCHENS, M.D.,

Major, Medical Corps, Army Medical School, Washington, D.C.

Among the infectious diseases none has responded more fruitfully to research than diphtheria. No such serious disease is easier to cure, and none is easier to prevent. At the same time no contagion better illustrates the wide difference that exists between the possession of knowledge and its effective application.

According to available descriptions diphtheria was well known in Egypt, Syria and Palestine even in ancient times. The Babylonian Talmud gives a reference to the disease "Askara"—probably derived from *sakhar,* meaning to stop up—which "according to some is like unto a ship's cable in the opening of the throat (for a ship's cable can only be drawn with difficulty through a small hole)."[1]

Hirsch[2] states that Cedrenus gives an account of an epidemic which in 1039 caused great mortality in certain parts of Byzantine. This disease was called by Cedrenus "cyanache"; Short (1799) refers to a kind of angina which prevailed in England in 1389 and carried off a great number of children; Frank von Wörd describes a plague epidemic in the Rhine region in 1517 in which the "tongue and throat, covered as by a fungus, became white." Hirsch gives many other references to the literature in which conditions unmistakably identical with diphtheria were described. Gradually attention began to be directed toward the different types of inflammation seen in the throat, and there were numerous discussions concerning the inflammatory nature and infectiousness of croup as compared with gangrenous angina, cyanache maligna, or angina gangrenosa.

Clear and final differentiation was not accomplished until Brettoneau,[3] a French army sugreon, made use of his opportunity to

* Lecture delivered at the Army Medical School, Washington, D.C., November 11, 1922.

study the infectiousness of diphtheria and wrote such an accurate description of it that nothing important has since been added thereto. In the year 1818 diphtheria was brought to Tours by a garrison transferred to that place from the Vendée. The epidemic continued to rage until 1820. For his observations he had, during this period, constantly from 120 to 400 patients.

"As it is impossible to apply to a special inflammation which is so well marked, any one of the improper names which have been given to each of its varieties, let it be permitted me to designate this phlegmasia by the name of Diphthérite, derived from *διφθέρα, pellis, exuvium, vestis coriacea*, whence comes *διφθερόω, corio obtego.*

"Diphtheritic inflammation is propagated in an altogether peculiar manner on the surface of the mucous membranes which it attacks; it spreads on them almost like a liquid which is effused or flows over them.

"We often see a long, narrow streak, of a dark red colour, which extends into the pharynx, or descends into the trachea, either alone or accompanied with other distinct striæ. A band of pseudo-membranous matter is formed in the middle of each stria. At this period some rounded pores, or rather some semitransparent bullæ, are still observed in the substance of the pellicle; the sides of this growing pellicle, irregularly crenate and attenuated, are confounded with the mucus which surrounds them, and which, without being altered in its appearance, is already altered in its properties, for it has no longer any viscosity, and is coagulated, ready to be concreted. Soon the bands are enlarged, they become more dense and homogenous, and form, by their union, complete tubes, of a single lamina, united to the mucous membrane by little prolongations which penetrate into the orifices of the muciparous follicles. If the pellicle is detached, the redness increases in the denuded points, the false membrane is reproduced, and in proportion as the superposed laminæ add to its thickness, it becomes more and more adherent to the organic surface. If it happens that such morbid processes take place in the respiratory canals, any chance of recovery is probably small."

The association of malignant angina with typical croup which he had observed in many cases, at first led him to think that the condition might be due to the occurrence of two diseases simultaneously, but the observation that adults who were suffering from malignant angina could infect children with typical croup, and the fact that the deposits on the tonsils and pharynx exhibited the same structure as the membranes of croup, convinced him that croup and malignant angina must be dependent on the same disease producing factor. He further differentiated between scarlet fever angina and diphtheritic angina, calling attention to the fact that while the diphtheritic membrane is formed upon the mucous membrane and can be

detached, in scarlet fever it is in the mucous membrane itself and the deposit cannot be removed.

Trosseau confirmed Brettoneau's work in its fundamentals but he did not share the view held by Brettoneau of the purely local character of the disease and substituted the name "diphthérie" (diphtheria) for "diphthérite" (diphtheritis); this change came slowly into general use and it was later accepted by Brettoneau himself.

Although Brettoneau's observations leave no question of doubt in our minds, his contentions failed to meet ready acceptance outside of France. In order to prove the infectiousness of diphtheria attempts were made to transmit to animals a condition which would exhibit a similar clinical picture. Such attempts were not fruitful although they continued almost uninterruptedly into the period when the association of bacteria with infectious disease began to attract universal attention.

To Klebs[4] belongs the credit for first recognizing the organism which causes diphtheria and for describing it with sufficient accuracy to make it readily recognizable. In his paper read at the Congress for International Medicine held at Wiesbaden in 1883, he stated that in sections stained with methylene blue he had found near the surface of the membrane a layer containing extremely short slender irregularly disposed rods barely attaining the dimensions of tubercle bacilli. Klebs erroneously considered the irregular staining to indicate the presence of spores, and he noted that spores were frequently present at each end of the rod, and under certain conditions some organisms showed as many as four spores. His attempts to obtain pure cultures of the bacilli were unsuccessful.

The next year (1884) Loeffler[5] reported the results of his studies of diphtheritic membranes stained with his special alkaline solution of methylene blue, and differentiated between the post-scarlatinal membranes containing micrococci in chains and a second group of thick false membranes containing rods arranged in groups and staining most intensely with methylene blue. By the use of a peptone broth containing grape sugar the cocci in chains were easily cultivated, but these were not uniformly present in the membranes from cases of human diphtheria and Loeffler considered them of merely secondary importance. Failing to obtain the rods in a number of cultural ex-

periments with the broth, Loeffler made use of another nutrient medium consisting of solidified blood serum containing 25 per cent. of the broth and obtained in the first experiment a positive result. Besides numerous small transparent colonies of cocci there grew upon the surface of the serum, distinct yellowish white colonies composed of rods which were identical in appearance with those found in sections of the membranes. Further investigations showed that the nutrient medium made use of was in fact the optimum medium for the cultivation of the rods, and is the medium still in common use for the bacteriological diagnosis of diphtheria.

It was some years before this work received full acceptance by other observers, and credit is due Loeffler himself for overthrowing one by one the objections advanced against the etiological significance of the diphtheria bacillus.

To Roux and Yersin[6] (1888, 1889, 1890) belongs the credit of first obtaining a diphtheria toxin. Though the toxins secured were weak compared with those obtained at the present time, their action on animals and other properties were so accurately observed that the memoirs of Roux and Yersin on the subject must always rank among the most noteworthy of the classics of experimental medicine. The fundamental studies made by Behring, Kitasato, C. Fränkel and Wernicke soon led to the subject being carried beyond the experimental stage.

It had already been noted by Loeffler[7] (1890) that a guinea-pig which had recovered from infection with diphtheria bacilli causing extensive necrosis of the skin, suffered only local swelling after a second injection and that subsequent injections produced only slight local reactions. Behring[8] in the same year (1890) began to work upon artificial immunization following indications given by experiments on the treatment of animals by means of chemical agents. In this first paper on diphtheria Behring made the following statement: "A method of immunization, which has not yet been used, consists in first infecting animals and then arresting the disease by therapeutic treatment. This method reminds one of the acquisition of immunity in man after convalescence from many infective diseases."

In this year (1890) likewise Behring and Kitasato[9] reported the discovery that "the immunity of rabbits and mice, immunized against tetanus, consists in the power of the cell-free blood fluid to render inocuous the toxic substances which the tetanus bacilli produce." They furthermore noted that this property is of such "a permanent nature that it is capable of acting when the blood is injected into other animals. The serum can therefore be used as a therapeutic agent."

Behring and Boer, Shubert and Canon, and Kossel and Korte tested the serum on children with favorable results. Aronson[10] (1893-1894) prepared a serum which gave excellent results when used on patients by Katz and Baginsky.[11] It was, however, only after Roux's remarkable work first published in September, 1894, at the International Medical Congress at Budapest that the antitoxin treatment of diphtheria became established on a firm practical basis.

The developments from that period up to 1913 were chiefly confirmative and educational. In the production of diphtheria antitoxin the two things of most importance that have led to improvement in the quality and applicability of diphtheria antitoxin are, first, the isolation and study by Dr. Anna Williams[12] of a strain of the diphtheria bacillus with remarkably high toxigenic power, and second, the elaboration by Gibson[13] and by Banzhaf,[14] in the laboratory of Dr. William H. Park, of methods for the refinement and concentration of the antitoxin bearing serum.

The demonstration that the diphtheria patient was a source of contagion early became the basis for public health regulations requiring the isolation of persons with the disease in order to limit its spread. Following the identification of the specific cause of the infection, bacteriological cure was soon recognized as the criterion upon which the duration of quarantine should depend. This meant in certain instances that isolation had to be maintained for extended periods and naturally the enforcement of the regulations met opposition. The accepted importance to the general population of such a measure, however, has largely overcome such opposition, especially since the hardship in general has been greatly reduced through tests for virulence of the organism remaining in the throat. The quarantine period is now declared at an end when virulent bacilli are no longer demonstrable.

With the enforcement of such measures it was sincerely believed by health officers generally that the incidence of diphtheria might be gradually reduced. The evidence at hand, however, seems to indicate that the accomplishments in this direction leave much to be desired.

During all the period of the antitoxin treatment of the disease, treatment which has resulted in a diminution of from above 40 per cent. to below 10 per cent. in the death rate, its incidence has been scarcely affected. In fact, recent figures published by the Public Health Service[15] indicate that during the last two years there has been an upward trend in the curve.

In this report the annual case rates per one thousand population for all states reporting are given as follows:

1921	1.90
1920	1.36
Median (for about the past 6 years)	1.20

It may be argued that this apparent increase in the number of cases is due merely to better notification. Granting even this the indication remains that the case rate is not diminishing. The mortality and morbidity rates in diphtheria have been carefully studied by James G. Cumming.[16] He discusses this matter as follows:

"True, the mortality from diphtheria and croup per hundred thousand population in the United States has been reduced 75 per cent. in the last thirty years (1890, 64 deaths per hundred thousand population; 1920, 15.3 deaths per hundred thousand). Notwithstanding this reduction in mortality, the number of cases per hundred thousand would seem to be approximately the same as thirty years ago. This is asserted on the basis of the following consideration: During the early nineties, various authorities, from personal experience, placed the mortality rate at from 25 to 40 per cent. On the basis, then, of an average 32 per cent. case mortality and a death-rate of 64 per hundred thousand population (40,677 deaths, 62,947,714 population) for 1890, there was an annual case rate for the total population of 200 per hundred thousand. It will be noted here that the case rate is determined from two fairly definite rates: Case mortality and population mortality rate. So, then, we may say that in 1890 there was for the total population of the United States a diphtheria mortality rate of 64 per hundred thousand, a case mortality rate of about 32 per cent., and a case rate of 200 per hundred thousand.

"In contrast to the rates for 1890, it is found that in the registration area (87 per cent. of the total population) there was for 1920 a mortality rate of

15.3 per hundred thousand, and, since the case mortality is about 8 per cent., the annual case rate for this average year is 200 per hundred thousand. As additional evidence that the rates for 1920 are approximately correct, the following is presented from a more elaborate report of 1919. From sixty-eight cities with a combined population of 27,148,810 there were reported 65,823 diphtheria cases: A case rate of 243 per hundred thousand population. There were 5404 deaths, making a case mortality of 8 per cent. and a population mortality rate of 20 per hundred thousand. This population is purely urban, and, to apply these rates to the entire United States, correction must be made for the rural population, where the disease is only 0.6 per cent. as prevalent as in the cities. When this is done it is found that the case rate is somewhat over 200 per hundred thousand population, the case mortality 8 per cent., and the mortality rate slightly over 15 per hundred thousand.

"Comparing the year 1890 with 1920, there is 75 per cent. reduction in case mortality (from 32 to 8 per cent.), which results in a 75 per cent. reduction in the mortality rate per hundred thousand population (from 64 to 15.3). But the disappointing feature is that the case rates per hundred thousand population would seem to be about the same (200) for the two average years in question."

DIPHTHERIA BACILLUS CARRIERS

In attempting to ascertain the reason for this continued prevalence of diphtheria, in spite of all we are doing to limit its spread, the most conspicuous factor at the present time is undoubtedly the human carrier of the infection. It is well known that while an adequate dose of diphtheria antitoxin relieves symptoms of the disease without delay, the antitoxin itself has no direct effect upon the number or virulence of the diphtheria bacilli in the throat or nose of the person so affected. Persons recover completely from the clinical manifestations of the disease while fully virulent microörganisms remain in their throats. In the literature there are references to individuals in whom the bacilli have persisted for more than a year. Many of these reports, especially the older ones, are based upon microscopic diagnoses alone; such studies are not reliable unless confirmed by virulence tests upon animals. Park[17] reports a case, however, in which fully virulent organisms persisted for eight months; he considers it safe to say that in over 10 per cent. of convalescent patients a few bacilli persist for two weeks after the disappearance of the exudate and in over 1 per cent. for four weeks. A well-recognized difficulty is that of demonstrating definitely the absence of bacilli.

For instance, from the crypts of hypertrophied tonsils two or three, or even more, consecutive cultures may be negative and a subsequent one show positive evidence of diphtheria bacilli. It is customary to keep convalescent patients in quarantine until two or three cultures are reported to be negative. The patient is then released. From a practical regulatory standpoint this is as much as can reasonably be enforced—it is possibly more than we can believe to be conscientiously and universally carried out. The result is that an unknown number of persons recovering from diphtheria, carry in their throats fully virulent diphtheria bacilli and mingle with the general population.

More important—since they are unsuspected and probably far more numerous—are the healthy persons, not known to have been in contact with patients, who harbor virulent diphtheria bacilli in their upper respiratory passages. Such persons are immune and therefore not susceptible to the disease, but their tissues locally permit the organisms to focalize, possibly in the crypts of their tonsils. During their carrying period it is of course just as easy for them as it is for convalescent carriers to transmit virulent bacilli to other persons. In this way not only do cases of diphtheria result among highly susceptible persons, but other healthy or so-called non-contact carriers are produced. There are then constantly among us persons who harbor virulent diphtheria bacilli in their throats and it is upon these persons chiefly that we must place the burden of maintaining the present high morbidity rate of diphtheria.

In a study of cultures from the throats of 4000 individuals Goldberger, Williams and Hatchel[18] found that thirty-eight of them were harboring in their upper respiratory passages, bacilli considered upon morphological grounds to be diphtheria bacilli. Of nineteen of these tested two were found virulent, suggesting that in this group of individuals 0.1 of 1 per cent. were actually carrying virulent diphtheria bacilli.

Carriers are sometimes classified as " transient " and " chronic." It is believed, chiefly upon theoretical grounds, that persons immune to diphtheria who have relatively normal throats offer little opportunity for diphtheria bacilli to focalize and if the organisms are

inhaled they are destroyed within a short time. Pathological conditions in the throat and in the nose, especially enlarged tonsils, undoubtedly favor susceptibility and focalization of diphtheria bacilli and such conditions greatly complicate efforts to end the carrier state in convalescents.

Treatment of Carriers.—In their efforts to shorten the carrying period, physicians have tested every remedy that might reasonably be expected to have a favorable effect and also many things without any sensible basis. It is unlikely that medication has any definite influence upon the length of the carrier state. Diphtheria bacillus vaccines have received adequate trial and their worthlessness has been amply demonstrated. At various times antidiphtheria bacillus serums have been prepared and used both by injection and locally. They are of no more value than normal serum. The use of physiological saline as a gargle accomplishes as much good as any of the mild antiseptic solutions. The latter, however, have the advantage of making the patient and family feel that something definite is being done to remedy a disagreeable situation, and for that reason "active treatment" is justified. Such treatment should probably be combined with applications of stronger disinfectants such as iodine or silver nitrate. Careful examination of a persistent carrier will be likely to show enlargement of lymphatic tissue in the throat or of a chronic inflammatory or atrophic process in the nose. In those cases with enlarged tonsils and with adenoids the most that can be looked for from the use of disinfectants is surface sterilization only. To end the carrier state complete enucleation of the tonsils and removal of adenoids are the only means likely to be effective. Nasal carriers are sometimes exceedingly persistent and may likewise demand surgical interference.

In preparing a diphtheria carrier for tonsillectomy or other operation the question arises as to whether or not a preliminary dose of diphtheria antitoxin should be administered. The need for this may be questioned since the fact that the patient has virulent organisms in his throat without showing symptoms of the disease indicates the possession of a high degree of immunity.

INDIVIDUAL SUSCEPTIBILITY

Schick Test.—With so large a percentage of undetected carriers in the population the wonder is not that diphtheria continues to be prevalent but that its incidence is not even greater. An explanation of this fact, especially for the low diphtheria morbidity among adults is afforded by the results of a test made upon individuals to determine their relative susceptibility to diphtheria. This test, first described by Schick[19] consists in the injection into the layers of the skin of a small amount of diphtheria toxin. Persons immune to the disease possess in their body fluids and tissues a certain amount of antitoxin. Schick and others state that so small an amount of antitoxin in the blood and tissue fluids as 1/30 of a unit per c.c. is sufficient to render the individual immune. With this amount of antitoxin, the toxin injected into the skin is quickly neutralized and produces no effect whatsoever, either local or general. If the person is susceptible to diphtheria, that is, if he possess less than 1/30 of a unit of antitoxin per c.c. of his blood, the cutaneous tissues locally are poisoned and local inflammation results. The test, therefore, is one for determining the presence of antitoxin and reveals the presence or absence of antitoxic immunity; that is immunity to the specific poisonous products of the diphtheria bacillus.

The Schick test does not reveal the presence of the condition known as cellular or antibacterial immunity—that is, the type of immunity following the prophylactic injection of typhoid vaccine. The proportion of persons who possess antibacterial immunity and its relative importance remain to be ascertained. There seems reason, however, to believe in its existence; many physicians who give positive Schick reactions frequently come into close contact with the disease without showing any evidence of infection.

The results of the studies made with the Schick test agree, however, with common experience concerning susceptibility to diphtheria, especially in its relation to the ages of greatest susceptibility. It is found that infants under six months of age are immune provided their mothers are immune, and the period of congenital immunity continues, if they are breast-fed, throughout the nursing period. The congenital resistance of the average child diminishes and the degree of its susceptibility increases rapidly up to the age of two years; the period of

greatest susceptibility is between six months and five years; after the age of five years, the percentage of susceptible persons gradually diminishes. This is clearly shown by the following table which gives the results of the studies of Park in New York City:

Age	Per cent. susceptible.
Under 3 months	15
3 to 6 months	30
6 months to 1 year	60
1 to 2 years	70
2 to 3 years	60
3 to 5 years	40
5 to 10 years	30
10 to 20 years	20
Over 20 years	15

Work subsequent to this by other persons leads to the belief that the average percentage of susceptible persons is considerably greater in country districts than it is in New York City. The reason for this is obvious. While the cause of the acquisition of resistance to diphtheria, that is the formation of antitoxin by the tissues, is not known positively, the most reasonable explanation seems to be that it is the result of small and repeated doses of virulent diphtheria bacilli, always sub-infective or causing infection so slight that it is not identified as diphtheria. The result is the gradual accumulation of antitoxic immunity, or possibly cellular immunity, or both. As noted above, no test has yet been devised by which persons with cellular immunity may be identified and the relative proportion of them is entirely unknown. There is some reason to believe, however, that pseudo-reactions may be a manifestation of sensitization to the diphtheria bacillus protein and that pseudo-reaction is a phenomenon similar to that of the typhoidin reaction. This is supported by the fact that adults show pseudo-reactions more frequently and more violently than do children. It must be remembered that the pseudo-reaction is not to be depended upon to reveal such information, however, because there are other substances to which the tissues may be hypersusceptible in the toxin injected besides the diphtheria bacillus protein.

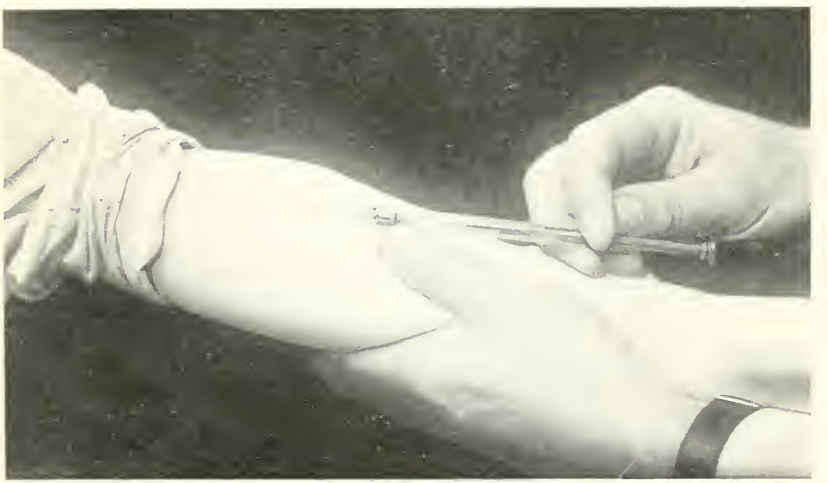
The material to be used for performing the Schick test is the sterile diphtheria toxin broth carefully standardized by injection into

guinea-pigs and diluted with sterile physiological saline solution so that the proper amount for injection is contained in 0.2 c.c. Guinea-pigs of approximately 250 grams weight are used for testing the toxin and the smallest amount of the toxin broth which will kill a guinea-pig on just the fourth day is called a minimum lethal dose (M.L.D.). It has been found that 1/50 of an M.L.D. is the amount best suited for the injection in order to detect susceptibility. Since freshly prepared toxin deteriorates with considerable rapidity only toxin which has aged a very long time—not less than six months—should be selected for making the test, and the higher its potency the more useful it is, since with high dilution the influence of those substances which produce pseudo-reactions is reduced. While the undiluted toxin broth is relatively stable after it has been aged, it is exceedingly unstable after dilution. Therefore the material is always supplied undiluted. In the packages are found a container of undiluted toxin and a bottle of sterile saline solution in such amount that a mixture of the two should give about 1/50 of an M.L.D. in the dose to be injected, usually 0.2 c.c. On account of the loss of material in manipulation and slight deterioration, Zingher has advised the use of 1/40 of an M.L.D. so as to allow for waste and assure the injection of not less than 1/50 of an M.L.D.

The syringe should show graduations in tenths and the style, generally called a tuberculin syringe, of long, slender pattern is preferred. The needle should be small, at least a 26-gauge sharp and of short bevel and made preferably of platinum-iridium.

In preparing the skin light scrubbing with acetone or alcohol or a mixture of the two is sufficient; the site selected is generally the flexor surface of the forearm. In making the injection the writer prefers to draw the skin taut with the free left hand and insert the needle while holding the syringe almost parallel with the arm. The most important point in the technic of making the injection is the method of holding the syringe (Fig. 1). Nothing could be worse than grasping the syringe barrel between the thumb and fingers as is generally done in making hypodermic injections. This necessitates removing the hand in order to make the injection and the necessary manipulations frequently result in dislodging the needle. Instead, the barrel of the syringe should be grasped just back of its flange

FIG. 1.



Proper method of holding the syringe for inserting needle beneath the skin in making the injection in the Schick test.

between the middle and forefingers, the thumb upon the distal side of the flange holds the syringe firmly. With the syringe barrel resting upon the forearm, the needle is inserted, very superficially, into the layers of the skin until the bevel just disappears. Then the thumb is in exactly the right position to be transferred to the plunger and make the injection. When the needle is removed there is frequently slight oozing, this is to be expected, and in general may be disregarded. The unheated diphtheria toxin should be injected always into the skin of the right arm and a similar injection should be made into the skin of the left arm, using the same lot of toxin which has been heated to 76° C. for five minutes in order to destroy the toxin itself. The heat does not destroy the diphtheria bacillus protein and other substances responsible for the pseudo-reactions. These are anaphylactoid in type and have nothing to do with antitoxin immunity.

Readings made at the end of twenty-four hours may reveal pseudo-reactions, but the typical Schick reaction is not specially marked within less than forty-eight hours and it usually becomes more intense after that. The most favorable periods for making readings are forty-eight hours and five days after the injection. Four results are possible:

1. Positive reaction;
2. Positive combined reactions;
3. Pseudo-reaction;
4. Negative reaction.

(1) The *positive reaction* is produced by the local irritant action of the diphtheria toxin and means that the tissues do not contain sufficient antitoxin to neutralize it; in other words, a positive reaction means the absence of antitoxic immunity to diphtheria. There gradually appears about the point of injection in from twelve to twenty-four hours a slight redness deepening into an area of distinct redness in the course of the next twenty-four hours. It reaches its height by the third or fourth day and then gradually disappears leaving a definite area of brownish pigmentation with a tendency to scaling; this persists for from three to six weeks. At its height the area of redness and infiltration is from one to two centimetres in diameter.

The intensity of the reaction as measured by redness and infiltration is in general an indication of the relative susceptibility of the individual.

(2) The *positive combined reaction* is the result of a positive and a pseudo-reaction in the same individual. In such individuals the control test made with heated toxin is similar but weaker. In these cases the test with the unheated toxin shows a central area of redness larger and better defined and the infiltration is greater. Furthermore, after the false reaction has subsided there remains the definite area of scaling brownish pigmentation.

(3) The *pseudo-reaction,* like other cutaneous allergic phenomena, appears earlier than the true or positive reaction—within six to eighteen hours and reaches its height within thirty-six to forty-eight hours. It disappears by the third or fourth day leaving a small pigmented area usually without a tendency to scaling and is less definite in outline. At its height it appears as a small central area of a dusky redness with a secondary areola shading into the surrounding skin; sometimes the pseudo-reaction is of a uniform redness and may be considerably larger than a true reaction. Those individuals who show only a pseudo-reaction possess antitoxin and are immune to diphtheria.

(4) The *negative reaction* means that the tissues contain sufficient antitoxin to neutralize the irritant effect of the toxin and is a definite indication of immunity to diphtheria—provided of course that the test toxin is of proper strength and has been injected intracutaneously. A negative reaction shows no area of redness or induration, or if there is a slight redness following the injection it is the result merely of traumatism and rapidly disappears.

For recording the results of the test, a convenient method is suggested by McGuire.[20] In the work at Camp Meade, Md., the following symbols were used:

Positive reaction	++
Positive combined reaction	+
Pseudo-reaction	+—
Negative reaction	—

These symbols are not intended to indicate the intensity of the reaction ("++" does not signify twice the degree of "+") but merely

identify its type. The first two are positive results and indicate susceptibility, the last two are negative results and indicate the possession of antitoxic immunity.

In the years elapsed since the first description of this test by Schick there has been ample opportunity to study its limitations. From the work chiefly by Park and Zingher in New York, the test has been made exceedingly practical and more and more it is being demanded by the people generally. Its application has become a routine practice in children's homes and in contagious disease hospitals and its reliability has been amply tested in the latter. Children found to be Schick negative, indicating their lack of susceptibility, do not get diphtheria when exposed to the infection and in the course of an epidemic such children may be safely ignored. The Schick test is so easy of application, so free from possibility of harm, so free from inconvenience of every kind there seems no reason why every individual in the entire population should not find out for himself whether or not he need fear diphtheria should it invade his home or should it be necessary for him to come in contact with it elsewhere in the performance of his duties.

The Schick test has revealed the reason diphtheria is no more prevalent among adults. We know now that a large proportion of persons beyond the age of twelve are immune, whereas a very high percentage of those between six months and five years are susceptible and this is the age in which diphtheria is most prevalent. Fully 70 per cent. of all cases of diphtheria occur in children under five years of age.

The Schick test when not properly performed, when the toxin is not of the proper strength and when the reactions are not read intelligently, is naturally capable of giving erroneous results. Sometimes even in the hands of persons who are expert it is difficult to be certain whether or not the reaction is positive. From his studies on diphtheria immunity and susceptibility Kellogg[21] has recently suggested a test which he believes may be relatively free from these objections. His test consists in estimating the actual amount of antitoxin in the blood by the Römer intracutaneous method. A small quantity of blood is taken from the finger (or ear) of the person to be tested, the amount usually collected for the Widal test being sufficient. This

is sent to the laboratory where the blood serum is collected and tested with standardized diphtheria toxin by injection of a mixture of the two into the layers of the skin of a guinea-pig. In this way it is a relatively simple matter to determine whether or not the blood serum of the individual under test contains 1/30 of a unit of diphtheria antitoxin or less. By a series of tests the actual amount of antitoxin in the serum may be readily ascertained. The California State Hygienic Laboratory has added this test to its activities and special outfits for the collection of the few drops of blood required are being distributed.

INDIVIDUAL PROPHYLAXIS: ACTIVE IMMUNIZATION OF SUSCEPTIBLE INDIVIDUALS

After having ascertained by the Schick test susceptibility to diphtheria the next problem is that of immunization. For this there are two methods, and the indications for each are quite clear. If there is reason to fear definite exposure an immediate injection of 1000 units of diphtheria antitoxin should be given. But for the general protection of all infants and certain groups of older persons we have in the toxin-antitoxin mixture a prophylactic measure of the greatest value. Several years ago Theobald Smith[22] called attention to the fact that neutral mixtures of toxin and antitoxin still possessed the power of stimulating the production of active immunity and suggested that such mixtures might be valuable for human prophylaxis. Park[23] had already used such mixtures for the preliminary treatment of horses in the production of diphtheria antitoxin. Behring actually tried toxin and antitoxin for the immunization of man and found that they did stimulate the production of a very solid immunity. But it is to Park again and his co-workers that we owe the elaboration of exact methods for the preparation and administration of the toxin-antitoxin mixture.

The prophylactic treatment consists of three injections of 1 c.c. each at weekly intervals—children under six months receive 0.5 c.c. The injections are given subcutaneously at about the insertion of the deltoid muscle exactly as bacterial vaccines are administered. No reaction develops in very young children but adults are likely to show redness and induration at the point of injection for the same reasons

that adults so frequently show pseudo-reactions after the Schick test. These reactions are never sufficient, however, to cause alarm and they disappear in from one to three days.

The toxin-antitoxin mixture contains a very slight excess of toxin. According to Zingher, each L+ dose should have mixed with it about 1.25 units of antitoxin. Therefore, each cubic centimetre is made to contain 3 L+ doses of toxin and 3.75 units of antitoxin. It will be remembered that the amount of diphtheria toxin which exactly neutralizes one unit of antitoxin is called L0 dose; the L+ dose is the amount of toxin which will kill a 250-gram guinea-pig on just the fourth day when that amount of toxin is mixed previous to injection with one unit of antitoxin.

The toxin-antitoxin mixture cannot be used as an emergency measure because the production of antitoxin following its injection is relatively slow. It may require as much as eight to ten weeks to produce sufficient antitoxin to give a negative reaction upon the application of the Schick test.

During their development periods it was thought the Schick test and the toxin-antitoxin treatment would be valuable chiefly to institutions. The time for urging their use upon children's homes and contagious disease hospitals is long past, for any such institutions must be hopelessly backward if they have not already instituted as routine procedures the testing of all inmates and entrants and the immunization of those found susceptible.

The greatest benefit will be derived from these measures only when they have been made the routine procedure in the practice of the family physician. With diphtheria still responsible for almost as many deaths annually as scarlet fever and measles together it would seem to be the duty of the physician to bring to the attention of parents the fact that while their child has a congenital immunity, this gradually disappears during the first six months. When, therefore, the infant has passed its first half year and enters its most susceptible period—between six months and four years—it should be tested and immunized if the Schick reaction is positive.

That this important matter should be discussed with parents early in the life of their child is evident from the fact that about 70 per cent. of the deaths from diphtheria occur in children under five years

of age. It is unnecessary to call attention to the importance of these measures to doctors, nurses and other persons whose duty it may be to care for diphtheria patients.

With regard to the immunization of adults, the severe reactions which may possibly result must be taken into consideration. This matter, especially from the standpoint of the Army, is discussed as follows:

"Natural immunity to diphtheria, possessed by about 80 per cent. of the adult population, is now believed to be due to recovery from slight infections repeated over a period of years. Such implantations of less than disease-producing doses of diphtheria bacilli stimulate the tissues to make the antitoxin which results in a negative Schick test. At the same time certain persons develop a hypersensitiveness to the proteins of the diphtheria bacillus. This is the reason it is necessary, in performing the Schick test, to make a control injection with heated toxin. Although the reaction of hypersensitiveness to proteins is different in many ways from that of sensitiveness to toxin, separation of the two phenomena may be made satisfactorily only when the reaction due to one of the elements alone can be subtracted from that due to the mixture. The unheated toxin contains both the toxic substance and the bacillary protein; the heated toxin contains the bacillary protein without the toxic substance. Therefore, any reaction elicited by the heated toxin is the result of hypersensitiveness to bacillary protein, it has no relation to immunity to the toxin (upon which immunity to clinical diphtheria depends), and susceptibility to diphtheria is to be considered as indicated by the reaction to the unheated toxin with the reaction to the heated toxin deducted.

"With the attention that has been given to the reactions in adults following the injection of the toxin-antitoxin mixture, the control test and the so-called pseudo-reaction assume more than the above-noted almost purely negative value. If these severe reactions in adults are the result of hypersensitiveness to the diphtheria bacillary protein, then the pseudo-reaction becomes a test for such hypersensitiveness and possibly a measure of its degree. In other words, the control test may indicate what fraction of the usual dose of toxin-antitoxin mixture for children it may be safe to inject into an adult as the initial dose.

"More extensive observations along this particular line are greatly needed at the present minute. So large a proportion of adults are found to react severely, Doctor Park does not even urge nurses to submit to the immunization treatment. They may receive the Schick test, but are treated, if found susceptible, only if, with full knowledge of the possible consequences, they still demand it.

"In considering this decision, we must remember that it concerns exclusively the civilian population, in which fully 70 per cent. of the cases of diphtheria occur in children under five years of age. Comparatively, therefore, the civilian health officer feels that diphtheria in adults constitutes so small a part of his problem it can be practically ignored. In this the problems of the army sanitarian are essentially different, he deals only with adults, and he knows that approximately 20 per cent. of these are susceptible to diphtheria. Therefore, this most efficient measure must not be discarded without a sincere effort to find a method

for its successful application in the army. Certainly, all physicians, nurses and corps men who are likely to come into contact with diphtheria should be given the Schick test, and the result recorded on their records. An effort should then be made to immunize all susceptible persons, using the severity of the pseudo-reaction as an indication for the size of the initial dose, and then estimating from this the amounts to be injected subsequently. Such injections must be given only to those who take them entirely voluntarily, and after the possibility of severe reaction has been clearly explained.

"In the present state of our knowledge, no mathematical relation between the severity of the so-called pseudo-reaction and the size of the initial dose of the toxin-antitoxin mixture can be formulated. However, persons who react severely should not be injected at all or should receive an extremely small amount, 0.1 c.c. of the mixture diluted 1-10 with saline. Persons who react mildly may be found to take 0.1 c.c. without difficulty. The initial dose for adults who show practically no reaction should probably not exceed 0.2 c.c. Subsequent doses will depend on the effect of the preceding injection. Following a very severe reaction, the amount should be cut in half; at least, not increased. If the reaction is not severe, the dose may be doubled each time until the maximum of 1 c.c. has been reached. The number of divided doses required to cause the Schick test to result negatively will depend upon their size. If they are small, six or eight may be required; if only slightly reduced with the final dose a full c.c., four or five will probably suffice, provided the mixture is up to the standard in potency.

"The relative efficiency of the treatment can be learned only by repeating the Schick test about six or eight weeks after the final dose of toxin-antitoxin mixture."

THE ADMINISTRATION OF ANTITOXIN

In reviewing our work upon the control of diphtheria it is apparent that in treatment alone has there been any noteworthy achievement. The death rate before the days of antitoxin was about 40 per cent.; it is now less than 10 per cent. With 200,000 cases in the country annually, antitoxin can therefore be credited with preserving the lives of about 60,000 persons each year. Our chief concern now is with the other 20,000. Until prophylactic measures have become universal in their application problems of diagnosis and early treatment and the details of treatment will still confront the physician.

Diphtheria is very much like a fire in a frame building. The immunity acquired by the use of the toxin-antitoxin mixture is a very efficient sprinkler system which never permits a fire to gain headway. If such an installation has been neglected and fire actually occurs it takes but little water to quench the conflagration if it is discovered early and water applied immediately, but neglected or undiscovered it will not be long before all the water in the world would be powerless

to save the structure. In the treatment of diphtheria early administration is of prime importance. It will be recollected that Dönitz[24] injected guinea-pigs intravenously, with a single fatal dose of diphtheria toxin. He had previously determined the smallest amount of antitoxin which would save the life of such a guinea-pig if the toxin and antitoxin were mixed previous to the injection. He could still save the life of the guinea-pig if the toxin was injected first and the antitoxin given after a delay of as much as nine minutes, but if he waited longer much more antitoxin was required to accomplish the same result, and at the end of one and one-half hours the guinea-pig died no matter how much antitoxin it received.

This corresponds exactly with practical experience; a small dose of antitoxin is sufficient if the patient is seen on the first day of the disease, but increasing quantities are required with each day's delay. The amount of antitoxin actually needed to effect cure depends, therefore, on the day of disease and its severity. The various writers on the subject of dosage advocate various sizes of doses; for mild cases, for instance, Park uses 5000 units, for severe cases 10,000 units, and for malignant, 20,000; while Woody for mild cases advised the use of 20,000 units, 30,000 units for severe, and as much as 150,000 units for malignant infections. All authorities agree in advising the use of an initial dose of sufficient size to bring about recovery without the administration of second and third injections.

The route of injection influences materially the efficacy of the antitoxin injected. When injected subcutaneously absorption is slow and as demonstrated in the following table the maximum concentration of units in the circulation is reached only after a delay of seventy-two hours, and never reaches the height attained when the injection is given intravenously.

The intravenous route makes the entire bulk of antitoxin available immediately and according to Park 5000 units injected intravenously is as effective as 20,000 units injected subcutaneously. The table shows, furthermore, that intramuscular injection is somewhat better than subcutaneous, but it scarcely compares with the intravenous route.

Some fear has been expressed that with the intravenous injection of antitoxin there is more danger of anaphylactic shock. But when

diphtheria infection has not been recognized until the third day of the disease and especially in patients with laryngeal diphtheria the danger from anaphylaxis is insignificant compared with the danger from the disease itself.

Antitoxin Content of Blood in Three Adult Diphtheria Patients.—Each received 10,000 units:

Method of injection:

Units in 1 c.c. at intervals of 48 hours.

	3 h.	6 h.	12 h.	24 h.	48 h.	72 h.	96 h.
Intravenous (1)	3.0	2.7	2.4	2.0	1.5	1.0	0.8
Subcutaneous (2)	0.1	0.2	0.25	0.4	0.55	0.65	0.7
Intramuscular (3)	0.2	0.35		0.6	0.6	0.59	0.55

Weight of No. 1, about 100 pounds; of No. 2, about 110 pounds; of No. 3, about 120 pounds.

Units in blood at:

	12 h.	24 h.	48 h.	72 h.
Single dose	0.25	0.4	0.55	0.65
Dose divided into three given at 12-hour intervals.....	0.08	0.2	0.48	0.62

The following may be used as a guide in the treatment of the various types of diphtheria. The dosage follows that advised by Park.

THE ANTITOXIN TREATMENT OF DIPHTHERIA

(1) The initial dose should be of such size that a single dose will suffice for the treatment.

(2) In mild cases the injection may be given subcutaneously, in moderate cases subcutaneously or intramuscularly, and in severe cases intravenously or intramuscularly.

(3) The standard dosage according to the severity of the disease and the route of injection are summarized in the following table:

	Mild	Moderate	Severe	Malignant
Units	3,000 5,000	5,000 10,000	10,000 20,000	15,000 40,000
Route	Subcutaneous or Intramuscular	Intramuscular or Subcutaneous	Intramuscular or half intraven. and half intramus.	Half intraven. and half intramus.

(4) Infants under two years will receive not less than one-half these amounts, with a maximum dose of 10,000 units; the dosage for older children is the same as for adults.

(5) Serum, especially for intravenous injection, at the time of its administration, must be warm—approximately the temperature of the body.

(6) With regard to anaphylaxis or serum shock, the danger is slight but occasionally a hypersensitive individual is found. Observance of the following precautions should identify such persons and obviate unfortunate consequences.

(*a*) If the case demands immediate treatment, give the doseage required without any delay.

(*b*) If delay of one hour is permissible, make an intracutaneous test as follows: With a small syringe (a 1 c.c. tuberculin syringe is best) remove one-tenth c.c. of the antitoxin to be injected and then fill the syringe up to 1 c.c. with sterile saline solution, mix thoroughly and inject one-twentieth c.c. of this dilution into the layers of the skin. A positive reaction will appear in from a few minutes to one hour.

(*c*) If this is positive, attempt to desensitize the patient by repeated small and gradually increasing subcutaneous injections.

(*d*) If there is a history of horse asthma, hay fever or other protein sensitization, proceed with caution, make multiple small injections and have everything in readiness to treat collapse—see "*f*" below.

(*e*) If the history and intracutaneous test are negative, give the subcutaneous treatment immediately; if injection is to be made intravenously, give immediately a subcutaneous dose of 1 c.c. and the entire treatment when arrangements are completed.

(*f*) Always give intravenous injections very slowly and be prepared to withdraw the needle and inject 0.6 c.c. of epinephrin (1 to 1000) solution at the first indication of collapse. In making intravenous injections dilute the serum with sterile saline solution (about 1 to 5)—the advantage of this lies in facilitating the slower introduction of the serum.

THE MANAGEMENT OF EPIDEMICS

The increasing use and availability of the Schick test and of toxin-antitoxin mixtures are having an influence upon the routine procedures for the management of epidemics, actual or threatened.

The appearance of a single case of diphtheria in a household calls for the same measures, with natural limitations, as must be applied in institutions, on board ship or at an army post. The physician is fortunate if a previous survey has identified immune or immunized individuals, for these will demand none of his attention, except in the search for carriers. The toxin-antitoxin mixture is not an emergency remedy, if immediate prophylaxis is, or seems to be, demanded antitoxin is indicated. Opinion is divided with regard to antitoxin for prevention, the majority of physicians now seem to favor waiting for the appearance of symptoms or signs of inflammation in the throat. Examinations of possibly exposed and susceptible persons are made at least twice a day and antitoxin administered immediately upon the discovery of the very first symptoms.

The activities called for by an epidemic may be tabulated as follows:

(1) Treat all patients with antitoxin according to the plan noted above and isolate them;

(2) Examine all other persons who may have been in contact with the patients, treat with antitoxin all showing suspicious symptoms or lesions of diphtheria and place such persons also in isolation;

(3) Make cultures from the noses and throats of all persons treated, to confirm the diagnosis;

(4) Make cultures from all other persons likely to have been in contact with patients and isolate those found to be positive. Examine all these persons carefully twice daily for any symptoms of the disease and administer antitoxin as soon as there is any suspicion that it may be indicated;

(5) Extend the culture survey as rapidly as conditions will permit;

(6) As soon and as rapidly as there is opportunity, make Schick tests upon all persons involved except those treated with antitoxin;

(7) When the epidemic has subsided, consider the immunization of susceptible (Schick positive) persons with toxin-antitoxin mixture. Children should certainly be immunized, adults may be if they demand it;

(8) As convalescence begins, cultures from both the nose and throat of patients should be made. If the carrier state is protracted, the cultures isolated should occasionally be tested for virulence; surgical interference should be called upon to aid in the elimination of virulent bacilli should they tend to persist. This may involve the removal of tonsils or adenoids or a nasal operation. The contact carriers should receive the same attention;

(9) Convalescent and contact carriers should be kept in isolation until two consecutive cultures taken at about three day intervals from both nose and throat fail to reveal the presence of virulent diphtheria bacilli.

The above plan will be varied by circumstances. A milk-borne epidemic, for instance, will show definite characteristics and call for the identification of the source.

CONCLUSION

The disease, diphtheria, formerly killed about 80,000 persons, chiefly children, in this country every year. At present, through the use of antitoxin the lives of 60,000 children are saved each year. Efforts now are extended toward saving as many of the 20,000 fatalities as possible. Much can be done through the more popular application of means to assure individual immunity.

Should the efforts of the anti-vivisectionists ever be successful in preventing the use of animals for scientific purposes, not only would we be unable to save the lives of any of the 20,000 children who are dying now, but we would go back to the loss of 80,000. What we know of the prevalence of diphtheria bacillus carriers makes us believe that this figure would be reached as soon as antitoxin should be withdrawn, for the reduction is due to antitoxin and antitoxin alone. Antitoxin is made by injecting horses with toxin; the blood serum of the treated horses is tested upon guinea-pigs. Are a few horses and a few guinea-pigs to be balanced against 60,000 children?

BIBLIOGRAPHY

[1] For the historical matter we have drawn freely upon NUTTALL and GRAHAM-SMITH, "Bacteriology of Diphtheria," Cambridge, 1913.

[2] HIRSCH: "Handbook of Geographical and Historical Pathology," Vol. 3, New Sydenham Society, London, 1886.

[3] BRETONNEAU: "Treatise on Diphtherite" *et seq.* in *Memoirs on Diphtheria*, The New Sydenham Society, London, 1859.

[4] KLEBS: Ueber Diphtherie, ihre parasitäre Natur, Verhältniss des localen Prozesses zur allgemeinen Infection, Contagiosität, Therapie (Chirurgie), und Prophylaxie, *Verhandl. des Congr. f. inn. Med.*, Wiesbaden, 1873, **2**, 125.

[5] LOEFFLER: Untersuchungen über die Bedeutung der Mikroörganismen für die Entstehung der Diphtherie beim Menschen, bei der Taube und beim Kalbe, *Mittheil. aus dem Kais. Gesundheitsamte*, 1884, **2**, 451.

[6] ROUX and YERSIN: *Annales de l'Inst. Pasteur*, 1888, 1889, 1890.

[7] LOEFFLER: Der gegenwärtige Stand der Frage nach der Entstehung der Diphtherie, *Deut. med. Woch.*, 1890, **16**, 81.

[8] BEHRING: Untersuchungen über das Zustandekommen der Diphtherie-Immunität bei Tieren, *Deut. med. Woch.*, 1890, **16**, 1145.

[9] BEHRING and KITASATO: *Deut. med. Woch.*, 1890, **16**, 1113.

[10] ARONSON: *Berl. Klin. Woch.*, 1893, Nos. 25 and 26.

[11] BAGINSKY: Die Serumtherapie bei Diphtherie, Berlin, 1895.

[12] WILLIAMS, ANNA W.: *Jour. Med. Res.*, 1902, **8**, 83.

[13] GIBSON: *Amer. Medicine*, 1905, **10**, 915.

[14] BANZHAF and GIBSON: *Serum. Jour. Biol. Chem.*, 1907, **3**, 253.

[15] PUBLIC HEALTH REPORTS, Jan. 13, 1922, p. 44.

[16] CUMMING: Is the Control of Diphtheria Leading to Eradication? *Jour. A. M. A.*, 1922, **78**, 632.

[17] PARK: Toxin-Antitoxin Immunization Against Diphtheria, *Jour. A. M. A.*, 1922, **79**, 1584.

[18] GOLDBERGER, WILLIAMS and HACHTEL: *Bulletin No. 101, Hygienic Lab., U. S. P. H. S.*

[19] SCHICK: *Münch. med. Wochenschr.*, 1913, **60**, 2, 608.

[20] MCGUIRE, LINTHICUM, SCHIRCH and NOURSE: *Military Surg.*, May, 1922.

[21] KELLOGG: A Test for Diphtheria Immunity and Susceptibility, *Jour. A. M. A.*, 1922, **78**, 1782.

[22] THEOBALD SMITH: *Jour. Med. Res.*, 1907, **16**, 359.

[23] PARK and WILLIAMS: Pathogenic Microörganisms, Led. Philadelphia and New York, 1920.

[24] DÖNITZ: Ueber die Grenzen der Wirksamkeit der Diphtherie-Heilserums, *Arch. internat. de Pharmacodyn.*, 1899, **5**, 425.

A STUDY OF SEVEN CASES THAT PRESENT DIASTOLIC HEART MURMURS *

By JOHN M. SWAN, HARRY D. CLOUGH, and JAMES M. FLYNN
Rochester, New York

In the course of routine physical examinations of 355 ex-service men, who had applied for compensation for ill-health which they believed had been incurred in the military service during the World War, seven cases were seen which presented heart murmurs of the character usually connected with the murmur of aortic insufficiency or regurgitation. The following is a short, composite description of the murmur: It is diastolic in time and usually occupies the whole of diastole. Its maximum intensity is heard in the second or third left intercostal space. It is transmitted along the left border of the sternum, sometimes to the ensiform cartilage, sometimes to the fourth or fifth interspace only. It may be heard in both the standing and the recumbent postures; and sometimes, but not always, it is louder in one position than in the other. It does not, as a rule, vary with the phases of the respiratory cycle. It is not much, if at all, influenced by exercise. It is constantly present.

The patients complain of dyspnœa and palpitation with nervousness and sometimes of subjective arrhythmia. There are none of the attendant physical signs of aortic disease: No left ventricular hypertrophy; no Corrigan pulse; and no capillary pulse. The systolic blood-pressure is normal or low, and the fifth point is well above zero.

The questions to be decided in this group of cases are: (1) Does this murmur indicate regurgitation through the aortic valve or (2) is it a functional murmur of the same class as the hæmic systolic murmurs that are so common? (3) Does this murmur, in the absence of cardiac hypertrophy and dilation, warrant a diagnosis of aortic regurgitation with its attendant prognosis? (4) Should the patients who present this murmur be treated as cases of cardiac disease?

Our understanding of aortic regurgitation is that it is the one

* Read at the thirty-ninth annual meeting of the American Climatological and Clinical Association, held at Washington, D.C., May 2, 3, and 4, 1922.

valvular defect that is attended by hypertrophy and dilation, by Corrigan pulse and capillary pulse, and by a blood-pressure in which, by the auscultatory method, the fifth point is often zero. Furthermore, the patients almost always give definite histories of antecedent rheumatic fever or some other so-called rheumatic disease (chorea, tonsillitis, torticollis) or of syphilis.

TABLE I.

	1052	1103	1132	1229	1262	1291	1365
PREVIOUS HISTORIES							
Rheumatic fever	No	Yes	No	No	Yes	No	No
Tonsillitis	Yes	No	No	No	Yes	No	No
Chorea		No	No	No	No		No
Torticollis		No	No	No	No		No
Syphilis	Denied	Denied	Denied	Denied	Denied	Denied	Denied
WASSERMANN REACTION	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
CARDIAC HYPERTROPHY							
Physical examination	Slight[2] No[2]	No	No	No	No ?	No	No
Electrocardiogram	No	No	No	No	No	No	No
Teleröntgenogram		Yes	Yes	Yes	Yes		Yes
CAPILLARY PULSE	−4	−2	−3	−2	+3	−2	−2
CORRIGAN PULSE	?2 −2	?1 −7	−5	−2	−2 +1	?1 −1	−2
FIFTH POINT							
BLOOD-PRESSURE	+1	−7	−7	−4	+1	−2	−2
ZERO	−5				−2		

One of the patients had had rheumatic fever at the age of twelve or fifteen years, at least twelve years before he reported to us for examination; a second patient of the group had had several attacks of tonsillitis and one attack of rheumatic fever in 1918; a third had had an "occasional sore throat." The other four had had neither rheumatic fever nor tonsillitis; none admitted having had syphilis; none presented a positive Wassermann reaction. On physical examination none presented definite cardiac hypertrophy. In one case at two out of four examinations the oblique diameter of cardiac dulness was slightly increased over the figure that we have taken as high normal for that diameter (15 cm.). In another case a questionable increase was recorded at one out of three examinations. In no case did the electrocardiographic examination show left ventricular or right ventricular preponderance. In one case a capillary

pulse was demonstrated at each of three examinations. Corrigan pulse was observed in one case at one of three examinations, and in three others it was questionable at one time or another, never positive. The fifth point of the auscultatory blood-pressure estimation was at zero in one case once out of six examinations; in another case once out of three examinations.

The discovery of the murmur of aortic regurgitation without the attending physical signs of that disease led us at first to believe that these patients were examples of an adventitious diastolic murmur of functional character. Hirschfelder [7] says that the possibility of functional aortic insufficiency must be borne in mind by the clinician; but that it can rarely be verified and that the clinical diagnosis is hazardous. Fahr, Carter, Cosgrove, and Edgar,[4] in examining 10,000 troops, found four recruits who presented diastolic murmurs which were very soft, usually heard only in the early part of diastole, and usually influenced by respiration, nearly disappearing on inspiration. White [11] says that a diastolic murmur beginning early and best heard down the left border of the sternum, associated with the water-hammer pulse, is pathognomonic of aortic regurgitation. This murmur may also be heard at the apex. Gittings and Smith,[6] as a result of work done at U. S. Army General Hospital No. 9, say: "In the absence of the concomitant signs usually found in this disease, the interpretation of a definite diastolic murmur at the left sternal border is open to some question, but can hardly be decided on any other basis than that of aortic insufficiency. Apparently this soft diastolic murmur is very frequently missed." Trémolieres and Caussade [10] are of the opinion that the murmur of aortic regurgitation, when heard at the left of the sternum, indicates that the case is a recent one, and that in old cases only is it heard to the right of the sternum. Butler [3] says: "The presence of an aortic diastolic murmur is, in the majority of cases, reliable evidence of aortic insufficiency. But, even with this murmur, it is not safe to make the diagnosis without the confirmatory evidence of a water-hammer pulse, throbbing carotids, capillary pulsation, and a pistol-shot sound in the femorals. If, however, the murmur is indistinct and is backed by a history of acute rheumatism in a young person, or of syphilis in a man of thirty-five or over, it is right to give the patient the benefit of the doubt and make the diagnosis on the murmur *per se*." King [8]

says: "The murmur of aortic insufficiency is not simulated frequently enough by accidental or cardiorespiratory murmurs to warrant question of the diagnosis, provided the typical murmur is present. Bret [2] maintains that a basal diastolic murmur may be functional, and quotes Devic and Bouchut in support of the contention. He admits, however, that as soon as one suggests that an aortic insufficiency is not the result of a lesion of the aortic orifice many objections are raised. He reports seven cases of functional aortic insufficiency and says that it is a condition that may be quite frequent in the cardiac disorders of patients with hypertension. Then he concludes: "Observed at the bedside, a Corrigan syndrome net emphasized (*souligne*) by a true diastolic hypotension ought rather to incline the diagnosis towards the hypothesis of a functional trouble." Gallavardin [5] has reported seven cases of aortic insufficiency in which the patients did not present a history of rheumatism, and he says that the absence of such a history may mislead the observer into an assumption of the existence of syphilis (unwarranted).

The determination of hypertrophy of the heart by percussion is well known to be open to many errors. Fahr, Carter, Cosgrove, and Edgar [4] point out this fact and make the following statement: "The determination of hypertrophy of the left ventricle is fraught with uncertainty in many cases if percussion and position of the apex beat are the only means for determining the left border of the heart." Mackenzie [9] points out that there may be little or no dilation in certain cases of aortic regurgitation; and King,[8] in a paper based on the examination of between 1500 and 2000 healthy soldiers, makes the following statement: "One sees many soldiers with aortic insufficiency who present no demonstrable hypertrophy of the heart, nor, indeed, any other secondary sign of the lesion. These men, also, frequently do not present symptoms their condition being discovered accidentally in the demobilization, after they have done full duty."

Cotton,[12] as a result of a study of fifty cases of aortic disease in soldiers at the Sobraon Military Hospital, Colchester, says: "The most constant sign by which we can recognize early aortic disease is a diastolic murmur. * * * The heart may be slightly enlarged; frequently, however, there is no increase in the area of relative cardiac dulness. The pulse is not collapsing; there is no conspicuous pulsation of the carotids or the brachial arteries; and

the blood-pressure range is within normal limits. * * * One frequently observes in electrocardiographing patients with aortic disease that hypertrophy is equally borne by the two ventricles, so that the normal relationship of the two is maintained."

ELECTROCARDIOGRAPHIC STUDIES

Method.—The electrocardiograms were all made under identical conditions: The patients lay flat on their backs in bed and Williams's German silver electrodes were used. The total resistances varied between 500 ohms and 1800 ohms, all being within the limit of 2000 ohms.[14]

Table II shows the various measurements and observations made upon the tracings of these seven cases.

The following summary shows the chief findings in this series of tracings:

Cardiac Rate.—The heart rate is found to be normal (below 80 with the patients reclining) in four of the cases. The other three cases show a simple tachycardia (Case 1103 rates 100 plus on two occasions; Case 1132, rate 93; Case 1365, rate 91). Of these latter three cases, two show a normal rate on one occasion.

Sinus Arrhythmia.—This is present in all seven cases, marked in two (1229 and 1262); moderate in two (1103 and 1365); and slight in three (1052, 1132, and 1291).

P-wave.—This is above the maximum normal height[16] in one case (1103); of longer duration than normal in two cases (Case 1103, 0.12 sec.; Case 1365, 0.12 to 0.14 sec.) and bifurcated or notched in one case (Case 1229).

R-wave.—This wave shows notching or thickening in all three leads in two cases (1052 and 1262); in two leads in one case (1365); and in Lead II only, in one case (1132). In one case (1103) it is above maximum normal height in all three leads at three different examinations.

P-R Interval.—A slight delay in conduction between auricles and ventricles is found in one case (1229). The P-R interval of Leads I and III measures 0.21 sec., that of Lead II, 0.23 sec.

S-T Interval.—This is of longer duration than normal[13,15] in three cases (Case 1229, 0.31 sec.; Case 1262, 0.30 sec.; Case 1291, 0.32 sec.).

Conclusion.—None of the cases shows evidence of preponderance of either ventricle. There are found to be numerous minor departures from the normal, none of which is common to all of the cases or even to a majority of them. It does not seem probable that any of the unusual features found in theses cases have any bearing upon the clinical findings.

DETERMINATION OF HEART SIZE

Method.—The method suggested and perfected by Bardeen[1] for determining heart volume was used in this investigation. Teleröntgenograms were made of the patients, the silhouettes were traced

TABLE II.

Case No.	Date		P	Q	R	S	T	P–R	R–T	S–T	Q–R–S	Rate Max.	Rate Min.	Resistance (ohms)	Auricular Complex	Ventricular Complex
1052	10–25–20	I	0.5	0.00	4.0	3.5	1.50	0.18	0.37	0.32	0.05					R–anacrotic notch
		II	0.5	0.75	11.5	0.0	1.75	0.20	0.38	?	?				P-poorly defined	R-catacrotic thickening
		III	−0.5	1.00	8.0	0.0	−1.00	0.18	0.36	0.30	0.06	68	65	1200		R-anacrotic notch
1103	9–14–20	I	1.5	1.00	15.0	1.0	1.50	0.16	0.34	0.28	0.06				P-lasts 0.12 sec.	
		II	3.0	1.00	36.0	0.0	D	0.16	?	?	?				P-lasts 0.12 sec.	T-unusual
		III	2.0	1.00	24.0	0.0	D	0.16	?	?	?	107	103	1800	P-lasts 0.12 sec.	T-unusual
	6–29–21	I	1.0	1.00	16.0	1.0	2.00	0.15	0.36	0.29	0.07				P-lasts 0.12 sec.	
		II	3.0	1.00	32.5	0.0	1.00	0.14	0.40?	0.34?	0.06				P-lasts 0.12 sec.	T-poorly defined
		III	1.5	0.00	17.5	0.0	D	0.14	0.34	0.28	0.06	75	65	1400	P-lasts 0.12 sec.	T-unusual
	12–16–21	I	1.0	1.00	14.5	1.5	1.0?	0.12?	?	?	?				P-lasts 0.12 sec.	T-poorly defined
		II	3.5	2.00	37.0	0.0	D	0.16	?	?	?				P-lasts 0.12 sec.	T-unusual
		III	2.5	2.00	24.0	0.0	D	0.16	?	?	?	103	100	1500	P-lasts 0.12 sec.	T-unusual
1132	10–14–20	I	1.0	0.50	9.0	4.0	1.0	0.16	0.30	0.26	0.04					
		II	2.0	0.00	9.0	3.0	3.0	0.18	0.32	0.26	0.06					R-slight anacrotic thickening
		III	1.5	0.00	2.0	4.5	2.0	0.18	0.32	0.27	0.05	93	93	800		Q-R-S unusual
	7–19–21	I	1.5	0.00	10.0	3.5	2.0	0.20	0.34	0.28	0.06					
		II	2.0	0.00	12.5	3.0	4.0	0.20	0.38	0.30	0.08				P-bifurcated.	R-anacrotic thickening
		III	1.0	0.00	3.0	3.0	2.0	0.20	0.36	0.32	0.04	71	67	1300		Q-R-S unusual
1229	7–1–21	I	0.75	0.00	5.0	3.0	2.5	0.21	0.36	0.32	0.04				P-bifurcated	
		II	1.50	0.50	15.0	1.0	6.5	0.23	0.38	0.32	0.06				P-notched	
		III	+1.0 to −1.0	0.50	11.5	0.5	4.0	0.21	0.36	0.30	0.06	65	47	1000	P-diphasic and not clear	
1262	5–18–21	I	0.75	0.50	7.5	1.0	3.5	0.17	0.35	0.28	0.07					R-catacrotic thickening
		II	0.50	0.50	14.5	3.0	3.25	0.18	0.38	0.32	0.06				P-poorly defined	R-anacrotic thickening
		III	−1.0 to +1.0	0.00	7.5	2.0	D	0.17	0.36	0.30	0.06	91	47	1800	P-unusual	R-anacrotic thickening
1291	7–16–21	I	1.50	0.00	10.0	0.5	2.0	0.17	0.38	0.32	0.06					
		II	1.50	1.00	14.0	0.5	2.5	0.20	0.38	0.32	0.06					
		III	0.75	2.00	3.5	0.0	1.0	0.20	0.39	0.34	0.05	68	60	500		R-notched
1365	10–24–21	I	1.0	0.00	14.5	0.0	2.5	0.16	0.38	0.30	0.08				P-lasts 0.12 sec.	R-thickened
		II	1.5	1.50	22.0	0.0	D	0.18	?	?	?				P-lasts 0.14 sec.	T-diphasic
		III	0.5	4.00	8.0	0.0	−3.0	0.16	0.32?	0.28?	0.04?	94	88	1200	P-poorly defined	R-catacrotic thickening

from the negatives and the areas were measured with a planimeter. The volumes were calculated from Bardeen's tables. The heights had been recorded with shoes on, and the weights had been taken with shoes, socks, union suits, and trousers. Height without shoes and weight without clothes must be used in computing heart volume by Bardeen's method. In order to make calculations comparable it was necessary to correct the heights and weights as follows: 1.25 inches were subtracted from the recorded height to compensate for shoes and four pounds were subtracted from the recorded weight to compensate for the clothing. This latter is based upon the following weights: Trousers with belt—1 lb., 5.5 ozs.; army shoes—1 lb., 14.5 ozs.; medium weight socks—1.5 ozs.; light union suit—5.5 ozs.; total—3 lbs., 11 ozs. The more important of these corrections is the height correction and this should be practically constant for all of the individuals (Table III).

Table III.

		Recorded Weights and Height				Corrected Weights and Heights			
		Weight		Height		Weight		Height	
Case No.	Age	Lbs.	Kilos	Inches	Cm.	Lbs.	Kilos	Inches	Cm.
1103	27	135	61.3	68.5	174	131	59.0	67.25	168
1132	28	113	51.3	67.0	170	109	49.0	65.75	164
1229	25	138	62.5	69.0	175	134	60.9	67.75	169
1262	25	132	60.0	65.0	165	128	58.1	63.75	159
1365	29	185	83.4	65.0	165	181	82.2	63.75	159

Three of the five cases show practically a normal weight for height (Cases 1103, 1229, and 1262). The other two cases show marked deviation from the normal weights for their heights. Case 1132 is 19 per cent. underweight and Case 1365 is 37 per cent. overweight (Table IV).

Table IV.

Case No.	Heart Volume c. c.	Ratio of Actual Weight to Weight Normal for Height	Heart Volume Relative to Body Weight	Heart Volume Relative to Height	Heart Area Square Centimetres
		Per Cent.	Per Cent.	Per Cent.	
1103	887	8−	41+	30+	141.18
1132	759	19−	46+	19+	126.75
1229	786	6−	21+	14+	129.81
1262	750	3+	22+	19+	126.31
1365	696	37+	20−	12+	119.75

HEART VOLUME VERSUS BODY WEIGHT

The ratio of heart volume to body weight varies from 21 per cent. to 46 per cent. above normal in four of the five cases. Case 1365 is 20 per cent. below normal. The actual significance of these facts must be decided with reference to the actual versus the normal weights of these individuals. From this standpoint it will be noted that the two columns of Table IV show an inverse ratio, *i.e.,* three cases (1103, 1132, 1229), which show an increased heart volume for body weight, are all below normal weight for height and the one case which shows a diminished heart volume when referred to body weight (Case 1365) is markedly overweight (37 per cent.). Case 1262 has the most nearly normal weight for height of the entire group.

HEART VOLUME VERSUS HEIGHT

All of the cases show a definite increase in heart volume when referred to height, varying from 12 per cent. to 30 per cent.

HEART VOLUME VERSUS BODY WEIGHT AND HEIGHT

Case 1103 shows the greatest cardiac enlargement of all, the weight being practically normal, while heart volume shows an increase of 41 per cent. and 30 per cent., respectively, when referred to body weight and height. This is evidence of marked enlargement.

Case 1132 has a heart volume which is increased 46 per cent. and 19 per cent., respectively, when referred to body weight and to height. This patient is 19 per cent. underweight, but even when allowance is made for this the heart volume is markedly increased.

Case 1229 has a heart volume which is increased 21 per cent. and 14 per cent. when referred to body weight and height. This patient comes within the normal range in regard to weight, so his heart volume is definitely increased.

Case 1262 shows a heart volume increase of 22 per cent. and 19 per cent., respectively, when referred to body weight and height. This patient's weight is the most nearly normal of the whole five so that we can conclude that his heart volume is markedly increased.

Case 1365 is the only one of the series which has a diminished heart volume relative to body weight. The heart volume is diminished 20 per cent. but the patient is 37 per cent. overweight. This patient should weigh 60 kilos (132 lbs.). If his weight were normal

for his height and his heart volume 696 cubic centimetres the heart volume would then be 9 per cent. above normal. The heart volume is increased 12 per cent. when referred to height. These facts would seem to indicate a borderline heart, but one which is still within the range of normal.

Composite Silhouettes.—A study of the composite silhouettes shows some rather interesting facts (Fig. 1.) Three of the five outlines fall rather close together (Cases 1132, 1229, 1262). The other two extend far beyond the lines of these three. One case (1103) falls far to the right and the other (1365) falls far to the left. The one falling farthest to the right is the largest heart of the five (887 cubic centimetres); the one falling farthest to the left is the smallest heart of the series (696 cubic centimetres) and is probably normal for the individual.

Total Transverse Diameter (Table V).—The fact that practically no reliance can be placed upon the measurement of the total trans-

Table V.

Total Transverse Diameters

Case No.	Heart Volume in c.c.	Total Transverse Diameter in Centimetres	Diagnosis
1103	887	15.3	Very marked cardiac enlargement
1132	759	13.5	Marked cardiac enlargement
1229	786	12.6	Definite cardiac enlargement
1262	750	13.2	Marked cardiac enlargement
1365	696	16.0	Probably normal heart volume

verse diameter of the heart silhouette as an index of enlargement is again emphasized by these composite silhouettes. The greatest total transverse diameter of the series is 16 cm. (Case 1365), which is found in a heart showing a normal volume. This heart certainly is of unusual shape and its total transverse diameter is 3 cm. greater than is usual for a heart of its volume (696 c.c.), and yet the heart volume is normal for the individual. The smallest total transverse diameter, 12.6 cm. (Case 1229) is found in a heart which shows definite enlargement.

Teleröntgenograms Versus Electrocardiograms.—The case showing the greatest increase in heart volume showed the most unusual electrocardiograms. Three different examinations were made after

FIG. 1.

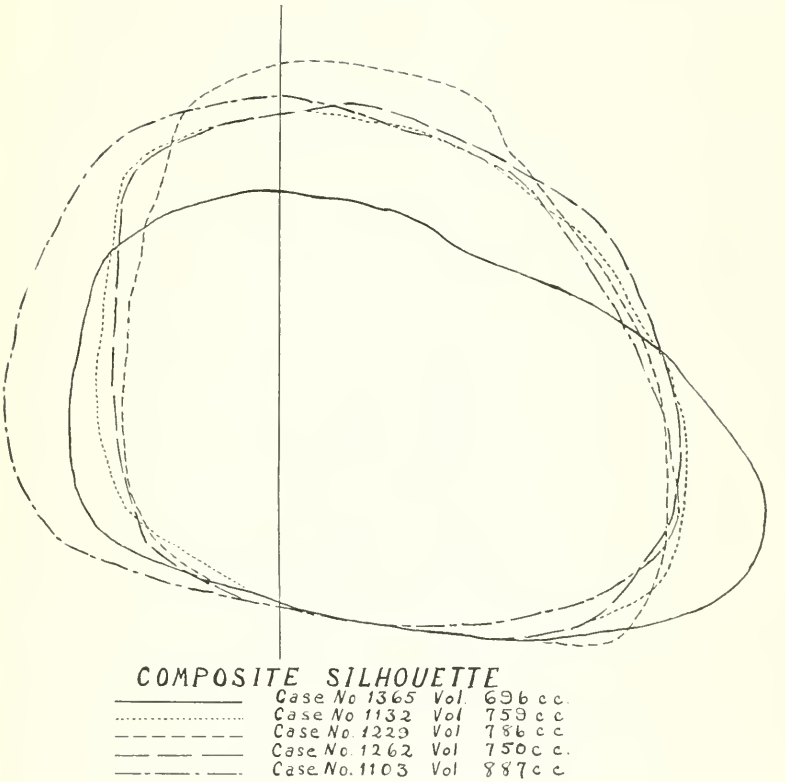
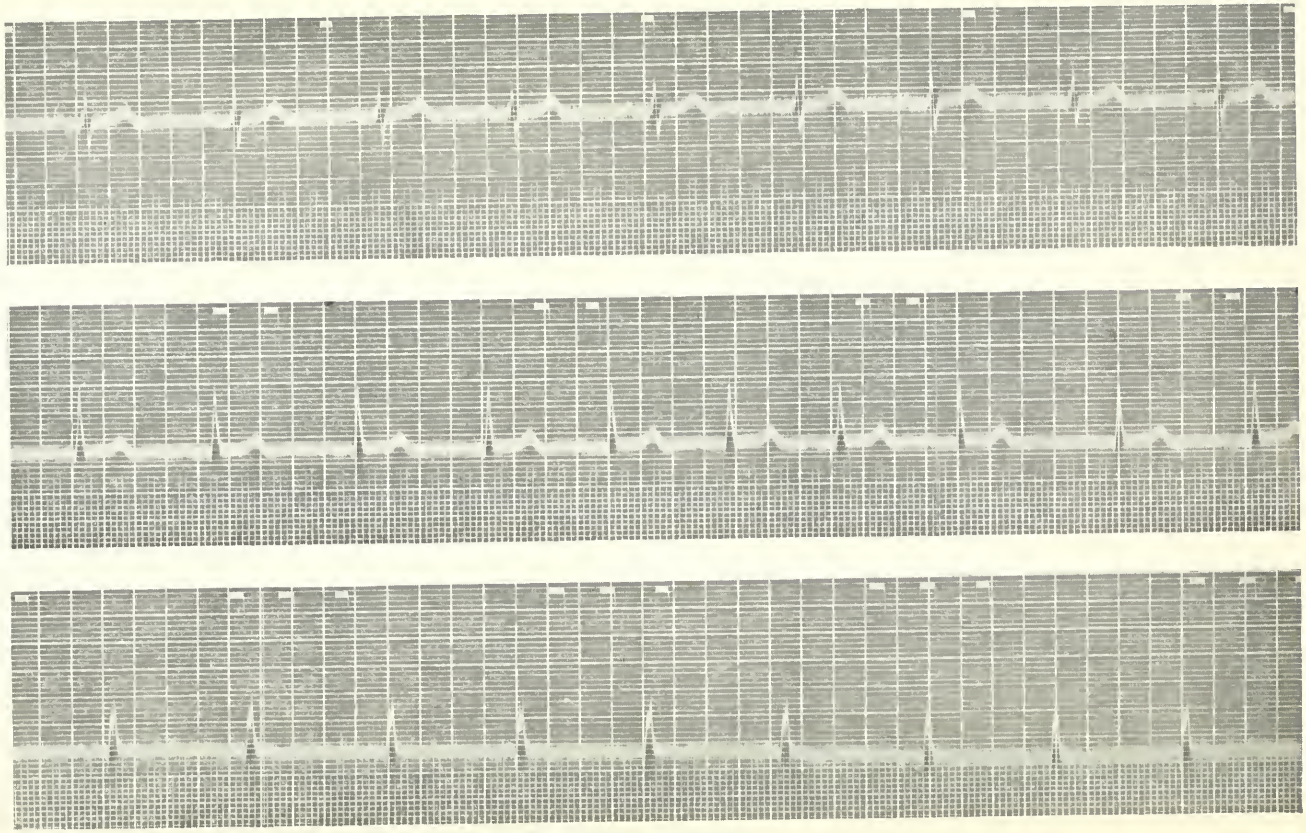

COMPOSITE SILHOUETTE
Case No 1365 Vol 696 c c.
Case No 1132 Vol 759 c c
Case No 1229 Vol 786 c c
Case No 1262 Vol 750 c c.
Case No. 1103 Vol 887 c c

FIG. 2.



Case No. 1052.

intervals of nine and six months, respectively, and the curves were practically constant in character. The P-wave was high and broad, lasting 0.12 second and suggesting auricular hypertrophy. The R-wave reached enormous heights, 32.5 mm. to 37 mm., and the T-wave was of curious contour. The teleröntgenogram of this case shows great extension to the right of the right auricular curve.

The only silhouette suggesting a possible left ventricular preponderance is that of Case 1365. This heart is of normal volume for the individual. The electrocardiograms of this case show no evidence of a left ventricular preponderance.

Conclusions.—We feel that the following answers should be given to the questions suggested at the beginning of this paper:

(1) This murmur indicates regurgitation through the aortic orifice.

(2) It is not a functional murmur.

(3) The murmur in the absence of hypertrophy and dilation warrants the diagnosis of aortic regurgitation and the attendant prognosis of that valvular lesion.

(4) The patients who present this murmur should be treated as cases of cardiac disease before the occurrence of broken compensation.

(5) Analysis of the few cases in this series seems to support the general belief that the teleröntgenogram offers the only method of determining actual enlargement of the heart. The electrocardiograms showed no evidence of left ventricular preponderance in any of the cases and the teleröntgenographic findings are in no instance at variance with these findings.

CASE RECORDS

Case 1052.—A man, aged 21 years, a draftman by occupation, was drafted in 1918 and volunteered for immediate service in the Motor Transport Corps. He was sent to Fort Sheridan, Illinois. He had no foreign service. While he was at Fort Sheridan he was well except for a cold. About two months after his discharge from the army he had a number of boils on various part of his body, and in February, 1919, he had influenza, abdominal type, and was in bed a week. He had been sick ever since that time, complaining of getting easily tired, pyrosis after eating, vertigo, gas in the stomach and twelve attacks of nausea and vomiting. The vomitus was brown and watery and sometimes contained undigested food. In May, 1920, he had nosebleed. He complained principally of being easily tired and he also had headaches every week or two; frontal and temporal, sharp, without radiation, which lasted four or five hours; and dyspnœa and palpitation of the heart on exertion and excitement.

CASE 1052—CARDIOVASCULAR EXAMINATIONS

Date	P. M. I.	Cardiac Dulness	Oblique Diameter	Murmurs	Diastolic Sounds	Muscular Quality	Thrill	Unusual Pulsation	Corrigan Pulsation	Capillary Pulse	Blood-pressure			Pulse	
											Systolic	Diastolic	Pulse	Recumbent	Standing
6–29–20	5i, 9.5	3i, 5i, 3.0, 10.5	16	Harsh S. m. apex and base D. m. base tr. ensiform max. 2li.	P>A	N	—	—	—	—	134	30	104	70	100
7–1–20	5i, 9.5	3i, 5i, 2.0, 10.0	14	Loud D. m., max. 2ri. tr. 5i, not to ensiform. SS. m. apex, tr. ax. not to angle scapula. SS. m. base tr. v. n. Recumbent: D. m. tr. ensiform.	A>P	0	0	0	?	—	134	40	94	48	70
7–12–20	5i, 9.5	3i, 5i, 2.0, 10.0	14	Standing none. Recumbent Loud D. m. base, max. 2ri, tr. 5i.	A>P	N	0	0	0	0	130	40	90	58	72
7–19–20	5i, 9.0			SS. m. apex tr. Ax. not to angle scap. SS. m. base tr. v. n. D. m. 2ri, tr. ensiform. Louder recumbent than standing.	0	0	0	0	0	0	132	30	102	66	84
8–17–20	5i, 10.0	3i, 5i, 1.0, 11.5	15	S. m. 2ri, v. n. D. m. base max. 2li, tr. apex and ensiform. S. m. apex tr. ax. not to angle scap.	A>P	N	0	0	0	0	128	45	83	48	70
1–21–21	5i, 8.0	3i, 5i, 1.0, 10.0	14	Standing: Late S. m. apex not tr. SD. m. 2li, not tr. Recumbent: Apex clear. S. m. 2li, not tr. D. m. base, heard 3li, disappears on deep inspiration.	A=P	N	—	—	?	—	141	0	141	52	74
10–4–21	5i, 10.5	2i, 5i, 3.0, 11.0	17	D. m. 2ri, tr. ensiform. Begins just after diastolic sound and lasts during diastole.	A>P	N	—	—	—	—	135	45	90	44	54

The family history was negative except that one brother had heart disease following scarlet fever.

The previous history showed that he had had diphtheria in 1903, influenza in 1919, and an occasional sore throat. Further than that he denied illness of every description. He had had no operations and had suffered no injuries.

His habits presented nothing seriously out of the ordinary. He denied the use of tobacco and of alcohol. There was a tendency to insomnia and constipation. His appetite was capricious, and he had stopped all exercise except walking because he was so easily tired.

Physical Examination.—The man was normal weight for his age and height, presented some acne on his face, tremor of the eyelids and hands, and athetoid movements of the tongue; both tonsils were increased in size and looked infected; and there was a small goitre; Wasserman reaction negative.

Cardiovascular Examinations (p. 186).

Blood Examination.—Erythrocytes, 5,710,000; leucocytes, 7520; ratio, 1-759; hæmoglobin, 88 per cent. (Sahli); color index, 0.78.

Differential count:

Polymorphonuclear neutrophiles	56.0 per cent.	4141
Lymphocytes	40.4 per cent.	3038
Large mononuclears	1.8 per cent.	
Eosinophiles	1.6 per cent.	
Basophiles	0.2 per cent.	
Total	100.0 per cent.	

Urine Examination.—Three examinations of the urine were made; in one of which there was a trace of albumin; less than 0.02 per cent. (Tsuchiya). Otherwise the urine examination was negative.

Electrocardiographic Examination (Fig. 2).—Made by Dr. Harry D. Clough, No. 91, September 25, 1920. Tracing made with the patient lying in bed. Resistance, 1200 ohms. A skeletal muscle tremor is present in Leads I and III, obscuring the electrocardiogram somewhat.

Lead I.—Average ventricular rate 65 per minute. A marked sinus arrhythmia is present. The P-wave can be definitely identified in only a few places owing to the skeletal muscle tremor which is present. The conduction time is at the upper limit of normal. A slight notching is present on the up stroke of the R-wave. The S-wave is marked in this lead.

Lead II.—The average ventricular rate is 68 per minute. A marked sinus arrhythmia is present in this lead as in Lead I. The auricular wave is poorly defined throughout the entire lead and can be identified in only a few places. The conduction time appears to be at the upper normal limit (0.20 sec). The deflection time is about 0.08 sec., and there is a suggestion of shading of the down stroke of the R-wave. The T-wave is well defined and positive.

Lead III.—The skeletal muscle tremor greatly obscures this tracing. The average ventricular rate is 68 per minute. The auricular wave cannot be distinguished. The deflection time appears rather long (0.08 second), and the R-wave shows a deep notching on the up stroke near its apex. Occasionally the notching occurs at the very apex of the R-wave.

Note.—It is not possible to decide absolutely in regard to the P-R interval; it appears to be at the upper normal limit at least, and it is possible that there may be some beginning delay.

CASE 1103—CARDIOVASCULAR EXAMINATIONS

Date	P.M.I.	Cardiac Dulness	Oblique Diameter Cardiac Dulness	Murmurs	Diastolic Sound	Muscular Quality	Thrill	Unusual Pulsation	Corrigan Pulse	Capillary Pulse	Blood-pressure			Pulse	
											Systolic	Diastolic	Pulse	Recumbent	Standing
8–31–20	5i, 8.5	3i, 5i, 2.5, 8.5	12	SD. m. base; max. 2ri. tr. ensiform. SS. m. base tr. v. n.	A = P	N	—	—	not typical	0	130	65	65	84	96
9–10–20	5i, 8.5	Not recorded	0	D. m. at base, tr. ensiform; max. 2ri. Presyst. m. apex; not tr.	0	0	presyst. apex	—	—	0	0	0	0	0	100
9–15–20	0	Not recorded	0	SS. m. apex and SD. m. apex. SS. m. base tr. vn. Loud, blowing Dm. base max. 2ri. tr. ensiform	0	0	0	0	0	0	0	0	0	0	0
3–15–21	5i, 8.0	3i, 5i, 2.0, 9.0	13	SD. m. base. max. 41i. tr. ensiform, heard over manubrium. Softer recumb. than standing. S. m. base and apex.	A > P	N	0	0	—	0	127	55	72	82	88
4–26–21	5i, 7.0	Not recorded	0	SS. m. apex, tr. axilla not to angle scap. S. and D. m. base. S. m. tr. vn. D. m. questionably tr.	0	0	0	0	0	0	131	88	43	0	0
6–21–21	5i, 7.5	3i, 5i, 2.5, 9.0	14	SD. m. all over precord max. 31i., tr. apex and ensiform. SS. m. 2ri. tr. harsh vn. (standing) SS. m. apex, tr. ax. not to angle scap. SD. m. base; max. 31i., tr. apex and ensiform. S. m. base tr. vn.	A > P	N	0	0	—	0	120	70	50	74	80

6–29–21 (Clough)	5i, 7.0	2r, 5i, 3.5, 9.5	14.5 (transverse)	S. m. apex, tr. ant. ax. line and towards ms. l. not to angle scap. Loud D. m. max. 4 rr. tr. ensiform (standing). S. m. apex tr. ant. ax. line, not to angle scap. D. m. as before S. m. base tr. vn. (recumbent).	P>A	N	syst. apex	epigast	—	0	118	85	33	72	80
9–5–21	5i, 8.0	3r, 5i, 1.5, 8.5	13	SD. m. apex. SD. m. 2ri, 21i, max. 31i, tr. ensiform (standing) SS. m. apex, not tr. S. m. 2ri, tr. vn. SD. m. 2ri, 21i, max. 3 and 41 i, not tr. SS. m. body heart (recumbent.	A>P	N	—	—	—	—	130	60	70	78	90
11–8–21	5i, 8.5	3r, 5i, 4.0, 9.5	15	Apex. clear SD. m. base max. 2ri. tr. r and l edges st. towards apex and to ensiform. After diastolic sound (standing) SS. m. apex not tr. S. m. 2ri, tr. vn. D. m. max. 2ri, tr. and l edges st. to ensiform (recumbent).	A>P	N	—	—	—	0	130	70	60	84	86
2–14–22	5i, 7.0	2i, 5i, 2.0, 8.0	14	SD. m. base and apex max. 31i. tr. ensiform and apex. heard r. edge sternum. (Recumbent). SS. M. apex not tr. SS. M base and body of heart, tr. vn. D. M. louder than standing.	P>A	N	—	—	—	—	124	65	59	72	80

Opinions are somewhat divided in regard to the basis for a diagnosis in intraventricular conduction defect; but it is certain that these electrocardiograms are not normal and are sufficiently suspicious to warrant further electrocardiographic study.

Diagnosis.—Marked sinus arrhythmia; intraventricular conduction defect.

Case 1103.—A man, aged 27 years, a candy-maker by occupation, was drafted in 1918. He was sent to Camp Devens and assigned to the Infantry. He was gassed in a defensive sector in August, 1918, and was returned to the United States as a sick casual in November, 1918. He was discharged on an S. C. D. for cardiac hypertrophy, and valvular heart disease, mitral and aortic insufficiency. After he was gassed he was blind and had respiratory symptoms with the expectoration of blood. Before he left the Base Hospital in which he was treated he began to have attacks of vertigo, palpitation, precordial pain and dyspnœa, which had continued until the time he was first seen. Sometimes he would have eight or ten attacks a day; at other times he would go two or three days with none. The attacks were usually brought on by exertion. The precordial pain was dull, vice-like, without radiation and was felt to the right of the sternum as well as over the precordium. He had had a few attacks of fainting and unconsciousness; irregular paroxysms of coughing without expectoration; no spontaneous dyspnœa; no abdominal pain; some nausea; no vomiting. He was very nervous and despondent, although he denied the latter condition.

The family history was negative; he was one of three children; all living; and his parents were not nervous.

The previous history showed that he had had a mild attack of scarlet fever in 1903; acute articular rheumatism in 1905 or 1908, affecting his knees, hips and wrists. He denied all other diseases. He had been married in April, 1919, and his wife had had one healthy child. He had had numerous furuncles on various parts of his body; particularly in the external auditory canals.

His habits presented no excesses in the use of alcohol or tobacco; but he was not bathing with sufficient frequency nor was he taking sufficient exercise.

The physical examination showed that he was twenty-one pounds underweight for his age and height; the occipitofrontalis control was irregular; he could wrinkle his forehead and frown; but there was a lack of relaxation between the movements. Dalrymple's and Mobius' signs were present; there was a slight exophthalmus, lachrymation while the eyes were being examined, tremor in the eyelids, and harsh breath sounds over the posterior aspect of the right lung.

Cardiovascular Examinations (pp. 188-189).

Wassermann reaction, negative.

Blood Examination.—Erythrocytes, 5,130,000; leucocytes, 9920; ratio, 1-517; hæmoglobin, 88 per cent. (Sahli); color index, 0.85.

Differential count:

Polymorphonuclear neutrophiles	78.8 per cent.	7746
Lymphocytes	13.2 per cent.	1309
Large mononuclears	3.0 per cent.	
Eosinophiles	4.0 per cent.	
Basophiles	0.8 per cent.	
Myelocytes	0.2 per cent.	
Total	100.0 per cent.	

Urine Examination.—Five examinations of the urine were made all of which were negative except for a low specific gravity in two (1.014 and 1.013); phosphates in two; and calcium oxalate crystals in one.

Electrocardiographic Examinations (Fig. 4).—Made by Dr. Harry D. Clough. No. 32, September 14, 1920. Tracing made with the patient lying in bed. Resistance 1800 ohms.

Lead I.—The average ventricular rate is 107 per minute. The electrocardiographic complexes are normal in form. The conduction time is normal (0.16 second). The T-wave is well defined and positive.

Lead II.—The electrocardiographic complexes are unusual in this lead. The auricular wave is very high (average 3 mm.); the R-wave is enormously increased, measuring 36 mm.; and the T-wave is of peculiar form consisting of a positive deflection followed by a very slight decline which becomes immediately continuous with the following auricular wave. The conduction time is normal (0.16 second). The average ventricular rate is 103 per minute.

Lead III.—The average ventricular rate is 103 per minute. The P-wave is well defined; the conduction time is normal (0.16 second). The R-wave here, as in Lead II, is unusually high, measuring 24 mm. The T-wave is diphasic.

Note.—The electrocardiographic complexes of Leads II and III are unusual in form but show normal time relations. There is no evidence of ventricular preponderance, right or left.

Diagnosis.—Simple tachycardia.

No. 287, June 29, 1921. Tracing made with the patient lying in bed. Resistance 1400 ohms.

Lead I.—Average ventricular rate 75 per minute. The P-wave is positive but rather variable in its form from a pointed to a very rounded wave. P-R interval normal (0.15 second). R-1 measures 16 mm. T-1 is positive and measures 2 mm. A slight sinus arrhythmia is present.

Lead II.—Average ventricular rate 68 per minute. This complex is very unusual in appearance. The P-wave is pointed and widely spread at the base; it averages 3 mm. in height. The P-R interval is 0.14 second. The R-wave is unusual in type, measuring 32.5 mm. in height. The T-wave is positive, but is poorly defined and appears to measure less than 1 mm. in height.

Lead III.—Average ventricular rate 65 per minute. The P-wave is well defined and positive; conduction time, 0.14 second. R-3 measures 17.5 mm. and the T-wave is diphasic.

Note.—The time relations are normal and there is no evidence of preponderance, but the R- and T-waves in Leads II and III are unusual.

Diagnosis.—No definite diagnosis can be made.

No. 414, December 16, 1921. Tracing made with the patient lying in bed. Resistance 1500 ohms.

Lead I.—Average ventricular rate, 103. The P-R interval is 0.12 second. The T-wave is poorly defined and in places is definitely negative. R-1 shows a respiratory variation in amplitude; from 14 to 15 mm. in height.

Lead II.—Average ventricular rate is 100 per minute. The complexes are all uniform, but are very abnormal in appearance. P-2 measures 3.5 mm. and is broad at the base. P-R interval measures 0.16 second. R-2 is of enormous amplitude, measuring 37 mm. T-2 is definitely diphasic.

Lead III.—Average ventricular rate is 103 per minute. The complexes in this lead resemble in a general way those of Lead II. P-3 is 2.5 mm. in height. The P-R interval measures 0.16 second. The R-wave measures 24 mm. with a slight respiratory variation. T-3 is diphasic. There is no evidence of preponderance of either ventricle.

Diagnosis.—Tachycardia, simple (average rate, 102). Average respiratory rate, 25 per minute.

Radiologic Examination.—Made by Dr. James M. Flynn. (Figs. 4 and 5.) November 10, 1921. A seven-foot plate made. Diameter of arch of aorta, 4.2 cm. Median right, 6.2 cm.; median left, 9.0 cm.

Otolaryngologic Examination.—Made by Dr. E. S. Ingersoll, October 12, 1920. Ears, drums normal; external otitis causing discharge. Nose, septum deviated to left, cutting breath capacity 50 per cent. Throat, tonsils fibrous but not very much enlarged; detritus in crypts. Tonsils should be removed. Naso-pharyngitis with heavy mucus discharge.

Case 1132.—A man, aged 28 years, a chauffeur by occupation, was drafted in 1918 and was assigned to the Motor Transport Service and sent to Camp Custer, Michigan. He had no foreign service. While in the army he was well except for a sprained wrist. At the time of his discharge he was told that he had heart disease; but aside from having a little dyspnœa when cranking his car he had no cardiac symptoms. Eighteen months after his discharge from the army he was complaining of dyspnœa on exertion and a sensation of weakness in his left side, with nearly constant palpitation. Once in a while he would have an aching precordial pain, without radiation. There has never been the sensation of impending death. There was an occasional non-productive cough.

The family history was negative.

The previous history was entirely negative; the only one of the diseases of childhood that he had had was measles. He had had no operations and had had no other injuries than the sprained wrist already mentioned.

His habits presented nothing abnormal.

Physical Examination.—The man was twenty-seven pounds underweight for his age and height; the occipitofrontalis control was lost and when he attempted to move the muscle he was able to wrinkle his forehead and there was a marked tremor in the muscle fibres, there was a tremor in the eyelids, enlarged tonsils, the posterior cervical, axillary, epitrochlear and inguinal lymph-nodes were palpable; there was cogwheel inspiration at the base of the left lung and at the left apex below the clavicle; and there was well-marked dermographia.

Cardiovascular Examinations (See opposite page).

Wassermann reaction, negative.

Blood Examination.—Erythrocytes, 5,870,000; leucocytes, 13,600; ratio, 1-425; hæmoglobin, 100 per cent. (Sahli); color index, 0.85.

Differential count:

Polymorphonuclear neutrophiles	58.6 per cent.	7969
Lymphocytes	34.4 per cent.	4678
Large mononuclears	2.2 per cent.	
Eosinophiles	4.4 per cent.	
Basophiles	0.2 per cent.	
Myelocytes	0.2 per cent.	
Total	100.0 per cent.	

Date	P.M.I
10–14–20	5i, 7
10–25–20	Not obtainable
12–6–20	5i, 7.5
7–19–21	Not obtainable
9–7–21	5i, 6
11–30–21	Not obtainable
1–21–22	5i, 7

CASE 1132—CARDIOVASCULAR EXAMINATIONS

Date	P.M.I.	Cardiac Dulness	Oblique Diameter Cardiac Dulness	Murmurs	Diastolic Sounds	Muscular Quality Systolic Sounds	Thrills	Unusual Pulsation	Corrigan Pulse	Capillary Pulse	Blood-pressure: Systolic	Blood-pressure: Diastolic	Blood-pressure: Pulse	Pulse: Recumbent	Pulse: Standing
10–14–20	5i, 7	3i, 5i, 1 5, 7 0	11	To and fro m. all over precordium. Max. 2i. D. m at apex and ensiform. S m. not tr. vn. or axilla; not heard in back. Louder recumb. than standing	P>A	N	0	0	0	0	122	60	62	96	104
10–25–20	Not obtainable	Left boder, 6 cm. left	0	S and D m. at apex D. m. heard max. S m. not tr. Soft S. m and D m. base. Max 2i S m. not tr. D m. tr. 5i. and apex.	0	0	–	0	0	0	124	70	54	78	100
12–6–20	5i, 7 5	3i, 5i, 1 5, 7.5	12.5	S. m. and D. m. apex. S m. tr ant. ax. line. D m. tr ant. ax. line. S. m. and D. m. base S m. not tr. D. m max 2 and 3i. tr. 4i, and apex, not to ensiform. Louder recumbent than standing Heard at ensiform recumbent	0	N	0	0	–	0	117	64	53	78	90
7–19–21	Not obtainable	3i, 5i, 2 0, 9 0	13	Soft D m. at apex with 2d sound S. m. 2n, and 2i, not tr. D. m base max. 2i tr. ensiform and apex. SS m. apex not tr.	0	N	–	–		–	122	50	72	72	96
9–7–21	5i, 6	3i, 5i, 1 5, 6 0	11	SS m. and SD. m 2i D m. to. ensiform; both heard 2n.	A>P	N	0	0	–	0	118	60	58	72	92
11–30–21	Not obtainable	3i, u. 6r, 2.0, 7.5	13	D m apex SS. m. base not tr D m. base. max 4i, tr. ensiform and apex.	A>P	Fair	–	epigastrium	–	–	124	68	56	66	74
1–21–22	5i, 7	3i, 5i, 1 0, 7.5	10	SS m SD m. 2i D m. max 3i, tr. ensiform.	P>A	N	–	–		–	130	70	60	84	94

Urine Examinations.—Twenty-one examinations of the urine were made in this case; eighteen of twenty-four-hour specimens, and three of single specimens. The total quantity varied from 750 c.c. to 1900 c.c. The specific gravity varied between 1.016 and 1.035. A trace of albumin was found in one specimen. The urine contained a substance that reduced Fehling's solution in sixteen specimens; in three the Fehling reaction was negative; and in two it was questionable. Nylander's reaction was tried in eleven specimens; positive in five and negative in six. The fermentation test was tried in ten specimens; positive in three; negative in two; questionable in five. The questionable reaction consisted of one very small gas bubble at the end of twelve hours. Quantitative determinations of glucose were made in four specimens, using Fehling's solution, with the following results: 0.19 per cent., equivalent to 3.61 gm. glucose in 1900 c.c. of urine; 0.159 per cent., equivalent to 2.2737 gm. glucose in 1430 c.c. of urine; 0.586 per cent.; and 0.570 per cent. Diacetic acid was never found.

Blood Chemistry.—Examination made by Dr. John R. Booth. Blood sugar on three occasions—0.093 per cent.; 0.186 per cent.; and 0.080 per cent.

Electrocardiographic Examination (Fig. 6).—Made by Dr. Harry D. Clough. No. 119, October 14, 1920. Tracing made with the patient lying in bed. Resistance 800 ohms.

Lead I.—Average ventricular rate is 93 per minute. S-1 is present. The complexes are normal in form. Conduction time is 0.16 second.

Lead II.—Average ventricular rate is 93 per minute. The P- and T-waves are well defined and positive. P-R interval is 0.18 second. S-2 is rather prominent.

Lead III.—Average ventricular rate is 93 per minute. The P- and T-waves are well defined and positive. The S-wave is prominent and notched on the down stroke. Conduction time between auricles and ventricles is 0.18 second.

Diagnosis.—Simple tachycardia.

No. 299, July 19, 1921. Tracing made with the patient lying in bed. Resistance 1300 ohms.

Lead I.—Average ventricular rate, 67 per minute. There is a slight degree of sinus arrhythmia. The complexes are all uniform and of normal appearance. The P-R interval measures 0.2 second. R-1 measures 10 mm. S-1 averages 3.5 mm. The T-wave is 2 mm. high.

Lead II.—Average ventricular rate, 71 per minute, with a very slight degree of sinus arrhythmia. The P-R interval is normal, 0.2 second. R-2 measures 12.5 mm.; T-2 measures 4 mm. and is positive. There is a suggestion of a bifurcation of the P-wave, but it is difficult to be sure of it.

Lead III.—Average ventricular rate, 69 per minute, with a slight sinus arrhythmia. The P-R interval measures 0.2 second. The beginning of the ventricular complex shows a marked M-shaped deflection. The T-wave is positive and measures 2 mm.

Diagnosis.—Normal electrocardiogram, showing a slight sinus arrhythmia.

Note.—There is no evidence of preponderance of either ventricle.

Röntgenologic Examination.—Made by Dr. James M. Flynn (Figs. 6 and 7), November 21, 1921.

Diameter of arch of aorta, 4.0 cm. M.R. diameter, 4.1 cm. M.L. diameter, 9.2 cm.

Laryngologic Examination.—Made by Dr. E. S. Ingersoll, November 23, 1920.

Ears, moderate retraction of the drums. Scar anterior right. Left normal. Function normal.

Nose, marked spur, high right. Deviation of septum to left. Patient has no complaint of inadequate breathing, but breathing capacity is 50 per cent. of normal.

Throat, tonsils large, fibrous. Seem quite clean at present. No evidence of absorption in cervical glands. Do not believe tonsils are causing much trouble.

Feces Examination.—Made February 6, 1922. Occult blood, negative.

Case 1229.—A man, aged 25 years, a telephone cable splicer by occupation, was drafted in 1918. He was assigned to an infantry regiment which was in the St. Mihiel offensive. He was neither wounded nor gassed. In training camp in this country he was well, but in the training area in France he began to get nervous, particularly after long marches. One day he dropped out of the ranks and had a crying attack that lasted for an hour, and at the same time he began to notice excessive sweating. He was not excused from duty, but continued his hikes and continued to carry his pack. During the St. Mihiel offensive he was without food for three days, except for hardtack that was soaked in water. Then he began to have diarrhœa with twenty-five to fifty stools a day, containing blood. He was hospitalized and was told by a medical officer that his diarrhœa was due to eating food saturated with gas. He returned to the United States as a sick casual, Class B2. At the time of his discharge the diarrhœa had been cured, but he felt nervous. He returned to civil life and took up his old job, but had to give it up in eight months because it was too hard for him. He complained of being weak and nervous, and two physicians told him that he had heart disease. The nervousness continued and he began to complain of aching eyes, blurring of vision, black specks, and flashes of light. About four months before he was first seen he began to complain of precordial pain, which was sharp, like a knife, and radiated toward the abdomen. This pain was paroxysmal and occurred sometimes two or three times a day; sometimes he would not have an attack for a week. The attacks of pain were accompanied by sweating and weakness. About a year before he was first seen he began to complain of dyspnœa and palpitation on excitement; there had been no spontaneous or nocturnal attacks.

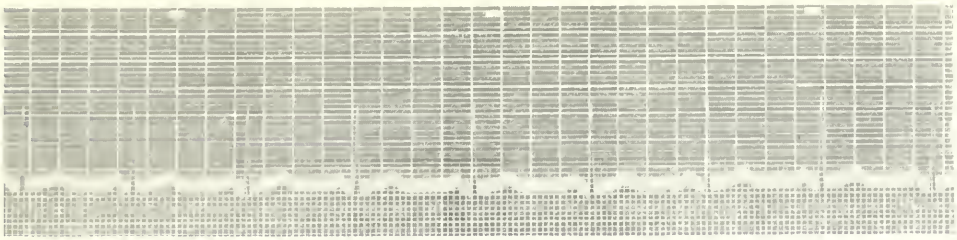
The family history showed that the patient was the son of a mother who had died of carcinoma of the breast at 38; he had one nervous brother and two nervous sisters.

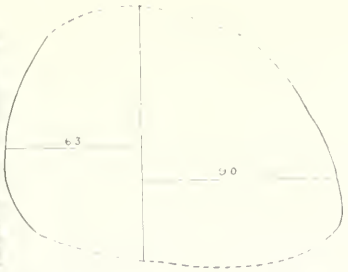
The previous history showed that he had had pneumonia and diphtheria in infancy; scarlet fever and septicæmia in 1907; pleuritis in 1916; influenza in 1916 and again in 1918; and dysentery in 1918. He had two or three attacks of coryza and bronchitis every winter. In 1915 he had had a nasal operation. As a boy he had been thin and delicate.

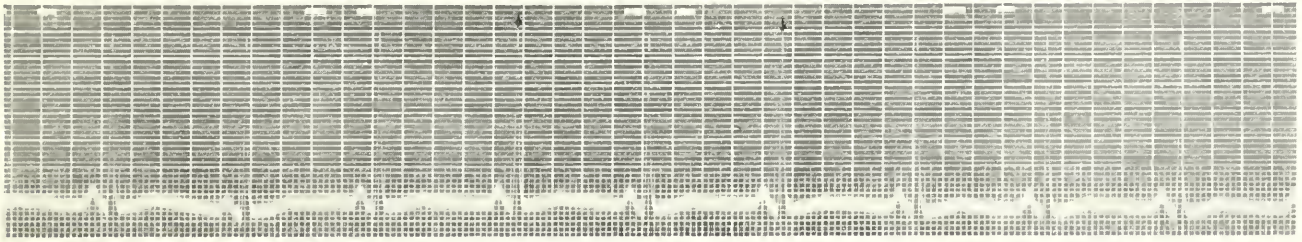
His habits were regular with the exception of anorexia and insomnia. He was of the opinion that he slept only about four hours every night, and was troubled by dreams in which people were being killed, but he did not dream about the war.

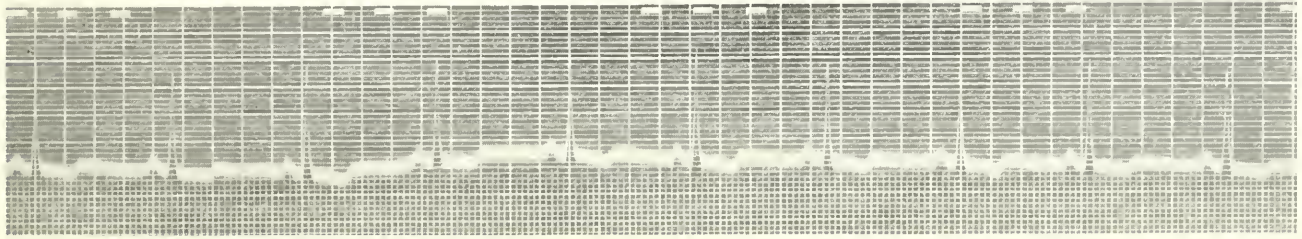
Physical Examination.—The patient was fifteen pounds underweight; his occipitofrontalis control was lost, pupils contracted; the lateral movements of the eyeballs were irregular and suggested nystagmus; there were tremors in the

FIGS. 3 AND 4.



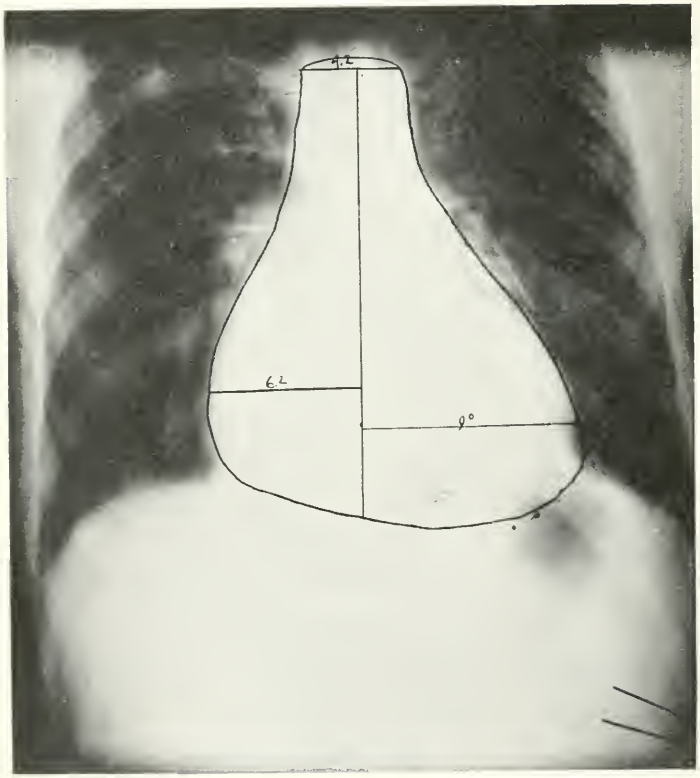






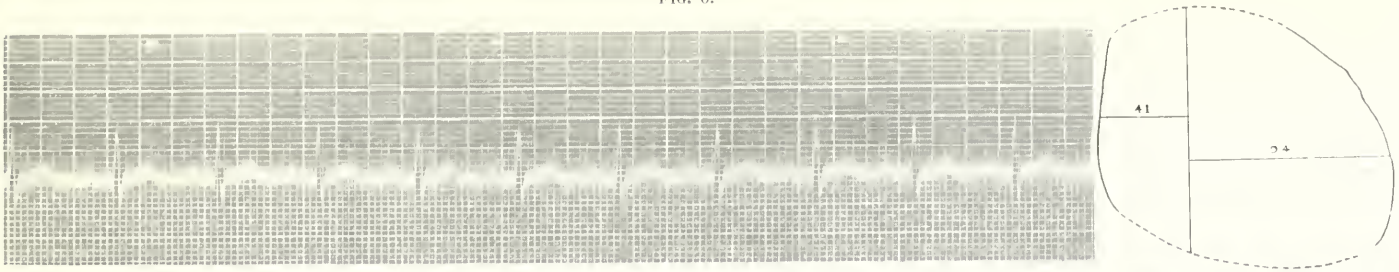
Case No. 1103.

Fig. 5.



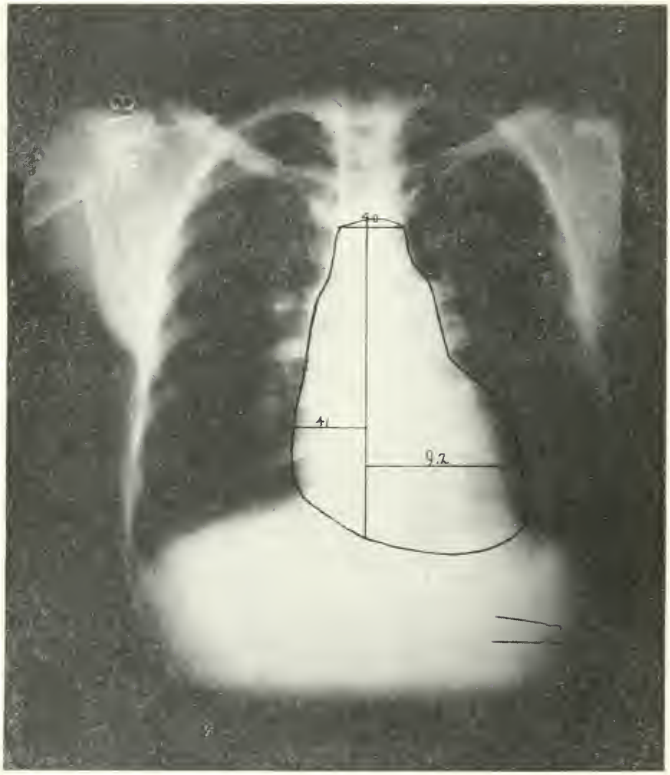
Teleröntgenogram of Case 1103.

Fig. 6.



Case No. 1132.

Fig. 7.



Teleröntgenogram of Case 1132.

eyelids and hands, the posterior cervical, right anterior cervical supraclavicular and inguinal lymph-nodes were palpable; there was a small goitre with a bruit over both lobes; dermographia was unusually prompt, deep, and persistent.

Cardiovascular Examinations (p. 196).

Wassermann reaction, negative.

Blood Examination, March 26, 1921.—Erythrocytes, 6,040,000; leucocytes, 8560; ratio, 1-705; hæmoglobin, 101 per cent. (Sahli); color index, 0.83.

Differential count:

Polymorphonuclear neutrophiles	51.8 per cent.	4434
Lymphocytes	41.0 per cent.	3509
Large mononuclears	3.4 per cent.	
Eosinophiles	3.0 per cent.	
Basophiles	0.8 per cent.	
Total	100.0 per cent.	

February 25, 1922.—Erythrocytes, 5.220,000; leucocytes, 7280; ratio, 1-717; hæmoglobin, 99 per cent. (Sahli); color index, 0.94.

Differential count:

Polymorphonuclear neutrophiles	49.8 per cent.	3625
Lymphocytes	37.0 per cent.	2693
Large mononuclears	9.8 per cent.	713
Eosinophiles	3.2 per cent.	
Basophiles	0.2 per cent.	
Total	100.0 per cent.	

Urine Examination.—Five examinations of the urine were made; two of twenty-four-hour specimens and three of single specimens. The total quantity varied from 560 c.c. to 1610 c.c. The specific gravity varied from 1.012 to 1.028. Three of the specimens contained less than 0.02 per cent. albumin (Tsuchiya). No glucose was found; phosphates were present in one; no casts were found; calcium oxalate crystals were found in one specimen.

Blood Chemistry.—Examinations made by Dr. John R. Booth. Two examinations were made; four months apart. The non-protein nitrogen was 35.0 mg. per cent. in one and 37.0 mg. per cent. in the other. Uric acid nitrogen was 2.7 mg. per cent. and 2.8 mg. per cent., respectively. Blood sugar was 0.10 and 0.08, respectively.

Electrocardiographic Examination (Fig. 8).—Made by Dr. Harry D. Clough.

No. 290, July 1, 1921. Tracing made with the patient lying in bed. Resistance 1000 ohms.

Lead I.—The average ventricular rate varies from 65 to 47 per minute, showing a rather marked sinus arrhythmia. The P-wave is positive, and the P-R interval is about 0.21 second. The R-wave is of low amplitude, measuring 5 mm. The T-wave is well defined, positive, and measures 2.5 mm. There is an S-wave which measures 3 mm.

Lead II.—The average ventricular rate shows about the same degree of sinus arrhythmia as is present in the previous lead. The P-wave is positive, measures 1.5 mm., and shows an irregularity on the down stroke. The P-R interval measures 0.23 second, showing a delayed conduction between auricles and ventricles. The R-wave measures 15 mm. The T-wave measures 6.5 mm. and is positive.

CASE 1229—CARDIOVASCULAR EXAMINATIONS

Date	P.M.I.	Cardiac Dulness	Oblique Diameter Cardiac Dulness	Murmurs	Diastolic Sounds	Muscular Quality	Thrill	Unusual Pulsation	Corrigan Pulsation	Capillary Pulse	Blood-pressure			Pulse	
											Systolic	Diastolic	Pulse	Recumbent	Standing
3–26–21	4i, 6.5	3r, u5r, 1.5, 8.0	13	Standing, none. Recumbent, D. m. base; max. 21i. tr. 4i, not to ensiform.	P>A	N	0	0	0	0	109	68	41	62	82
5–10–21	4i, 8.5	3i, u5r, 1.5, 8.5	13	Standing, SD. m. 2ri. Recumbent, HD. m. 31i, not tr.	A>P	N	0	0	0	0	105	55	50	60	80
6–30–21	4i, 7.5	3r, 5r, 1.0, 8.0	12.5	Standing, none. Recumbent, D. m. base; tr. 4i; not to ensiform or apex.	A>P	D	—	—	—	—	124	60	64	72	104
1–22–22	4i, 6.0	3i, 5i, 2.0, 7.0	12.5	None standing or recumbent. After exercise questionable D. m. base not tr.	A>P	N	—	—	—	—	105	50	55	58	80
2–21–22	4i, 6.5	3i, 15r, 1.5, 6.5	14.5	SD. m. 31i, not tr. louder recumbent than standing	P>A	N	—	—	—	—	112	50	62	60	74

CASE 1262—CARDIOVASCULAR EXAMINATIONS

Date	P.M.I.	Cardiac Dulness	Oblique Diameter Cardiac Dulness	Murmur	Diastolic Sounds	Muscular Quality	Thrill	Pulse		Blood-pressure			Pulse	
								Usual Pulsation	Corrigan	Capillary	Systolic	Diastolic	Pulse	Recumbent	Standing
5–18–21	5i, 9.0	3i, 5i, 1.5, 10.5	13	SD. m. apex. SD. m. base, max. 31i, tr. ensiform and apex. Heard both recumbent and standing	A>P	N	systolic in subclavian arteries	—	—	+	133	55	78	66	90
10–1–21	5i, 8.5	3i, 5i, 1.0, 8.5	12	SD. m. base, max. 31i, tr. 5i, not to ensiform	P>A	N	—	—	+	+	143	40	103	70	98
1–19–22	6i, 7.5	3i, 6i, 1.5, 8.0	12.5	D. m. base, max. 41i, tr. 51i, and apex. Recumbent louder, not heard at apex.	A>P	N	—	—	—	+	140	40	100	70	94

Lead III.—The average ventricular rate shows the same degree of sinus arrhythmia as is seen in the other two leads. The P-wave is slightly diphasic, although in places it is definitely positive and in other places definitely negative. An irregularity is noted on the initial stroke of the P-wave. The R-wave measures 11.5 mm. The T-wave is positive and averages 4 mm. in height. The conduction time is difficult to determine on account of the character of the P-wave, but is probably longer than normal.

Diagnosis.—Marked sinus arrhythmia. Delayed conduction between the auricles and ventricles.

Röntgenologic Examination.—Made by Dr. James M. Flynn (Figs. 8 and 9), January 20, 1922. Diameter of the arch of the aorta, 5.0 cm. M.R., 3.4 cm. M.L., 8.9 cm. There is a very slight increase over that of normal.

Case 1262.—A man, aged 25 years, a laborer by occupation, enlisted in 1917 for the medical department. He went first to Columbus Barracks, and was transferred to Walter Reed Hospital, where he served until he was discharged on a certificate of disability in 1918. At Columbus Barracks he was well and at Walter Reed Hospital he was well until he was admitted to the wards for tonsillitis with general muscular pains. His statement of his condition is: "The tonsillitis ran into rheumatism and the rheumatism left the leaking valve." At the time of his discharge from the army he was not complaining of symptoms. After his discharge from the army he worked on a farm; for a florist; for an electric manufacturing company; back to farm work; and when he was first seen he was working for a cabinet-making firm. During that period he had an attack of tonsillitis, and tonsillectomy was done. At the time he was first seen his only complaint was of gas in the stomach. The attacks occur three or four times a week and are not attended by nausea or vomiting. He had had a little dull precordial pain at irregular intervals, without radiation, and occasional dyspnœa.

The family history showed one case of heart disease, three cases of nervousness, and one case of rheumatism.

The previous history showed that as a boy he had been sickly, complaining of stomach trouble; he had had several attacks of tonsillitis, acute articular rheumatism in 1918, tonsillectomy in 1920, and frequent attacks of coryza. He had had no injuries.

His habits presented nothing out of the ordinary. He denied the use of tobacco and alcohol. He took almost no exercise.

Physical Examination.—The patient was nine pounds underweight; there was some acne on his back; the occipitofrontalis control was lost; Dalrymple's sign was present; there was beginning arcus senilis; the teeth showed five gold crowns, one of which was tender; the posterior cervical, axillary, and inguinal lymph-nodes were palpable; there was a small goitre with a bruit over the right lobe; in the left axilla there was an area of dulness at the fourth rib and in the fourth interspace, with cogwheel breathing at the base of the left lung; dermographia, and exaggerated knee jerks.

Cardiovascular Examinations (p. 196).

Wassermann reaction, negative.

Blood Examination.—Erythrocytes, 5,870,000; leucocytes, 11,280; ratio, 1-520; hæmoglobin, 102 per cent. (Sahli); color index, 0.86.

Differential count:		
Polymorphonuclear neutrophiles	60.2 per cent.	6790
Lymphocytes	27.8 per cent.	3135
Large mononuclears	2.4 per cent.	
Eosinophiles	8.8 per cent.	992
Basophiles	0.8 per cent.	
Total	100.0 per cent.	

Urine Examination.—Two specimens of urine were examined: One passed at the time of the physical examination showed an alkaline reaction and a specific gravity of 1.012; the other, a twenty-four-hour specimen, showed a total quantity of 1870 c.c., a specific gravity of 1.017, and uric acid crystals in the sediment.

Feces Examination.—An examination of the feces showed neither ova, protozoa, metazoa, nor embryos.

Electrocardiographic Examination (Fig. 10).—Made by Dr. Harry D. Clough. No. 269, May, 18, 1921. Tracing made with the patient lying in bed. Resistance 1800 ohms.

Lead I.—Average ventricular rate, 67 per minute. A rather marked sinus arrhythmia is present, maximum rate being 73 per minute; minimum rate, 63 per minute. The complexes are all normal in form. The P-R interval measures 0.17 second. The T-wave is positive and measures 3.5 mm. R-1 measures 7.5 mm.

Lead II.—Average ventricular rate, 67 per minute. The sinus arrhythmia noted in Lead I is very much more marked in this lead; maximum rate, 68; minimum rate, 48 per minute. The P-wave in this lead is rather poorly defined, but is positive in sign. The P-R interval is within the normal limit, 0.18 second. R-w measures 14.5 mm. T-2 is well defined, positive, and measures 3.25 mm. The complexes are of normal form. The deflection time is 0.06 second.

Lead III.—Average ventricular rate during the first portion of the tracing is 65 per minute, for eleven seconds. Following this there is a progressive increase in rate during two cycles and then a fairly constant rate of 91 per minute is seen during the rest of the tracing; about six seconds. Associated with the slow rate is an inversion of the P-wave and a rather poorly defined diphasic T-wave. When the rapid rate is assumed, the P-wave has become upright and the T-wave better defined, in places positive and at other points again diphasic. There appears to be a slight change in the conduction time associated with this change in rate: During the period of slow rhythm the P-R interval measures 0.16 second; whereas during the period of rapid rhythm the conduction time is slightly prolonged to 0.18 second. R-3 is notched throughout; it varies in amplitude from 6.5 to 8.5 mm. These variations appear to be rhythmic and associated with respiration.

Diagnosis.—Normal electrocardiogram showing a marked sinus arrhythmia.

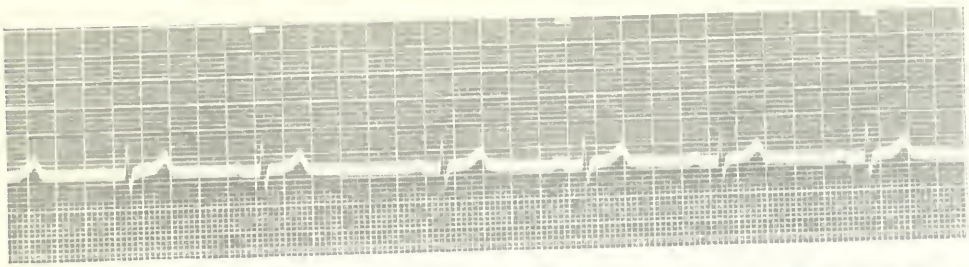
Note.—The changes in the complexes noted in Lead III are believed to be due to a migration of the pacemaker within the sinus node.

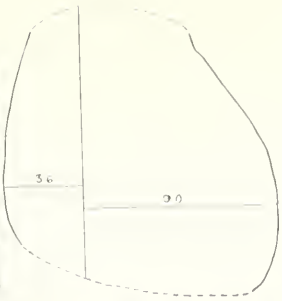
Röntgenologic Examination (Figs. 10 and 11).—Made by Dr. James M. Flynn, January 20, 1922.

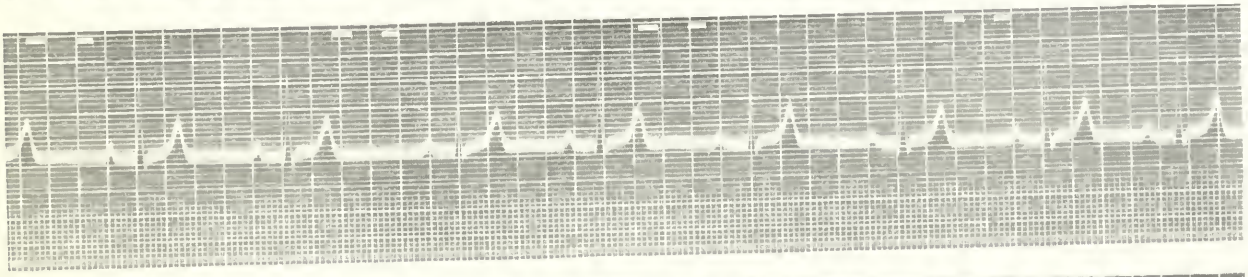
Diameter of the arch of the aorta, 4.3 cm.; M. R., 3.7 cm.; M.L., 9.4 cm. There is a slight increase in the left heart.

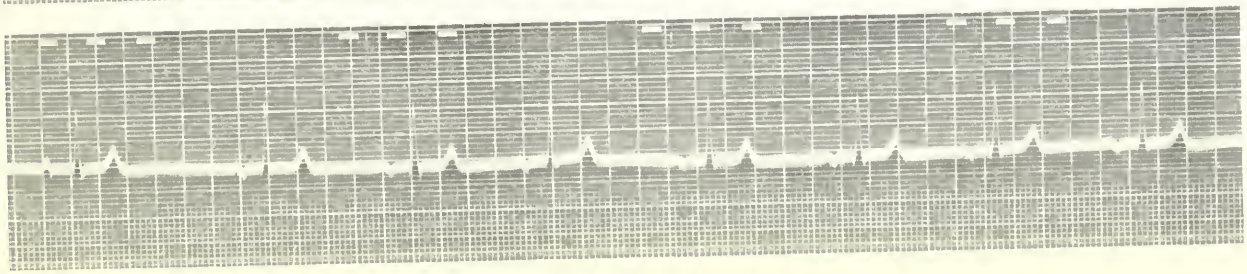
Case 1291.—A man, aged 27 years, a machinist by occupation, enlisted in 1918 for the pioneer infantry. He was sent to Camp Wadsworth; was in the

Fig. 8.



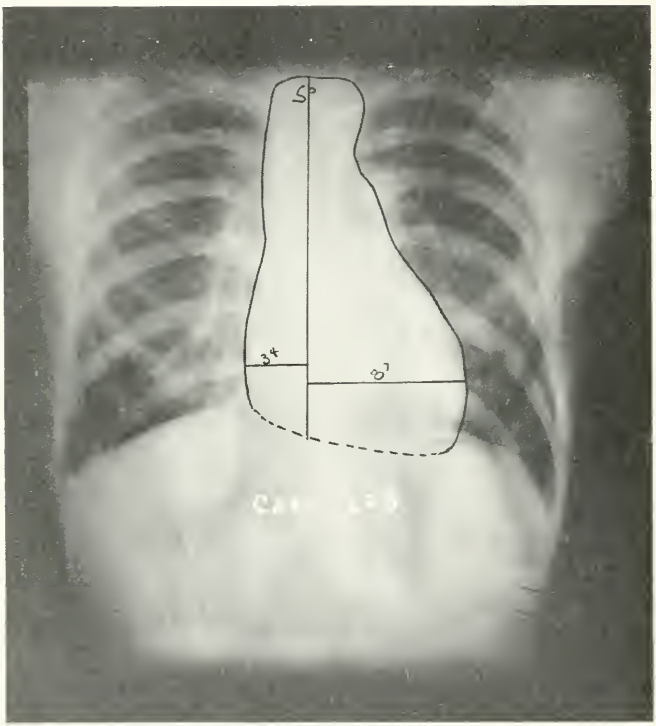






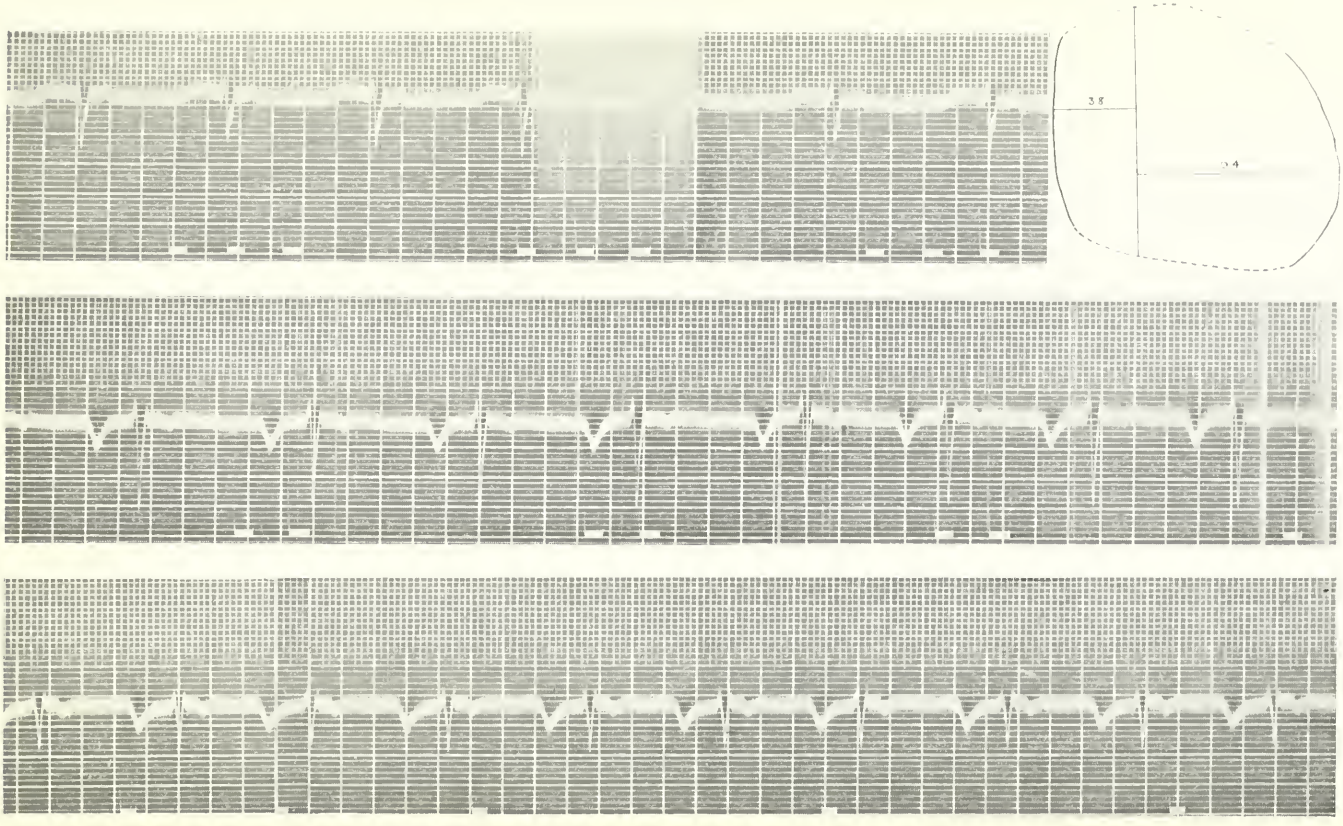
Case No. 1229.

Fig. 9.



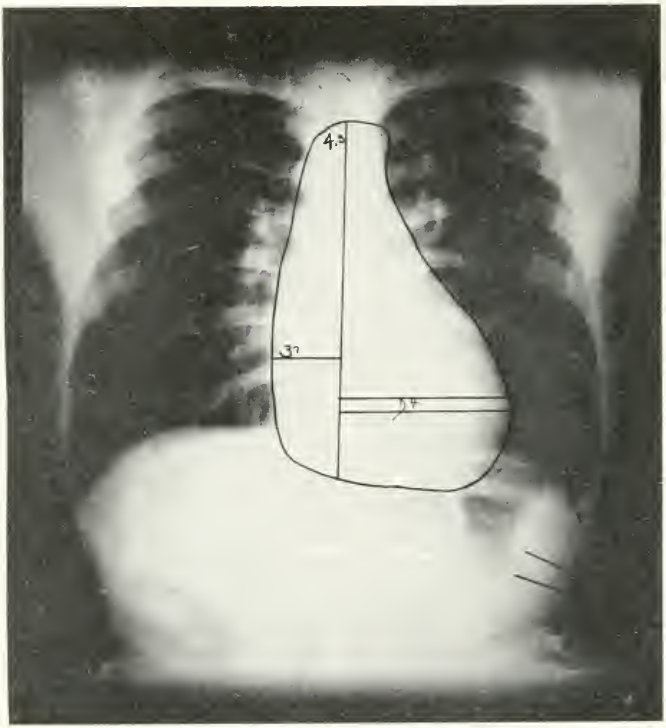
Teleröntgenogram of Case 1229.

Fig. 10.



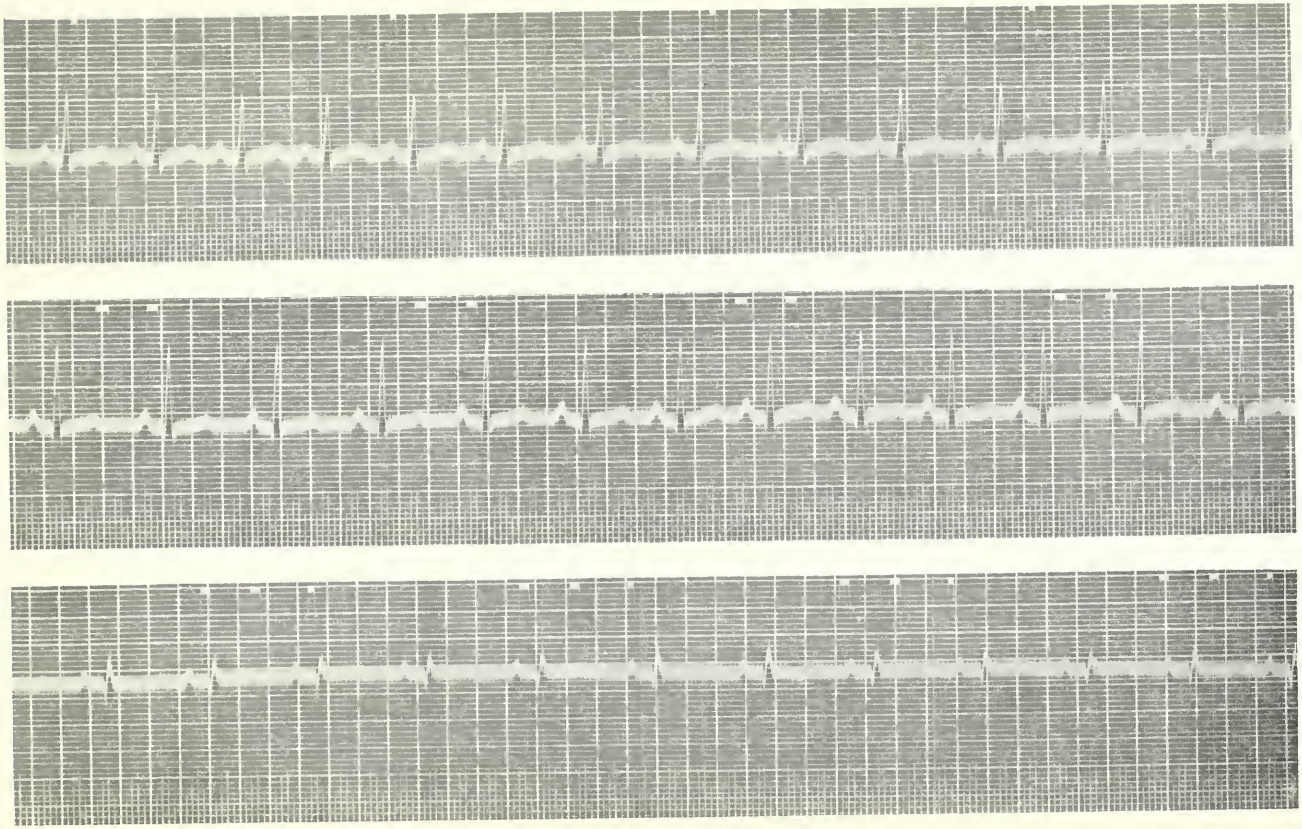
Case No. 1262.

Fig. 11.



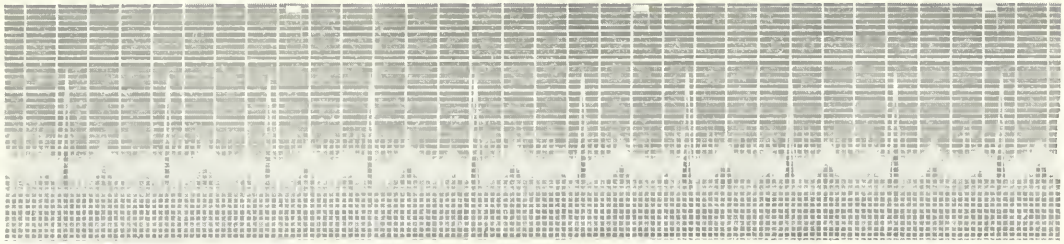
Teleröntgenogram of Case 1262.

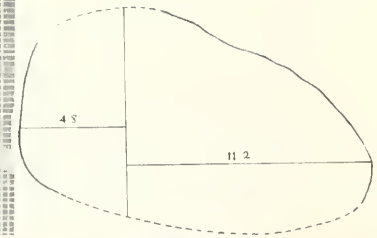
FIG. 12.

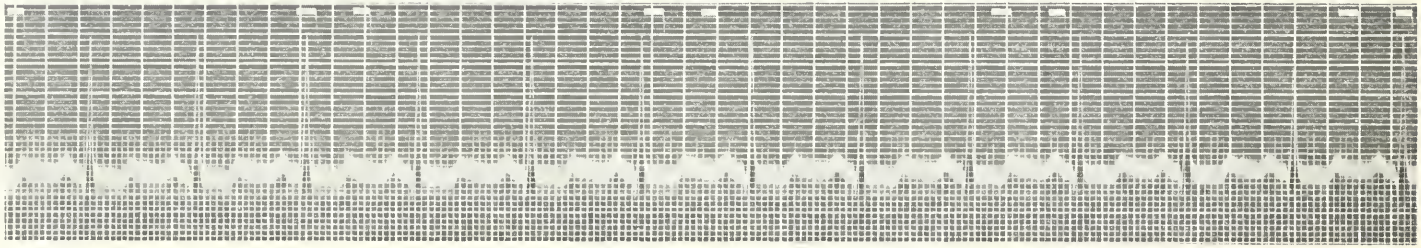


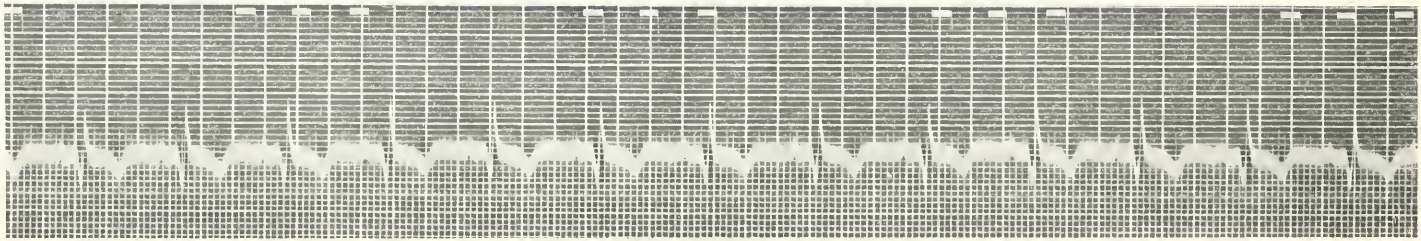
Case No. 1291.

FIG. 13.



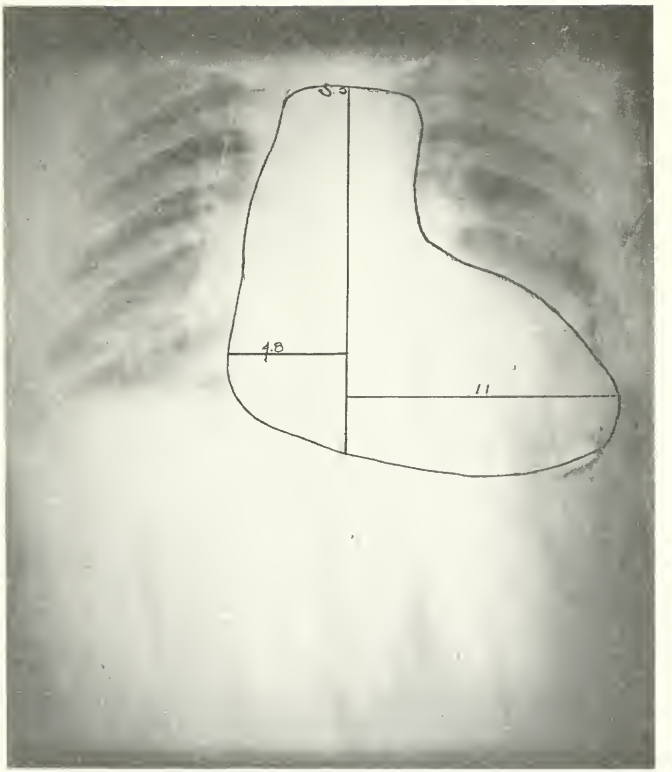






Case No. 1365.

Fig. 14.



Teleröntgenogram of Case 1365.

Meuse-Argonne offensive. He claimed to have been gassed in November, combined respiratory and abdominal types; but he did not report it because "someone told me that they would kill you in the hospital if you went there." He was in the Third Army and did duty in Germany, returning to the United States in June, 1919. He claims that he began to be dizzy as soon as he was gassed and that the dizziness had continued from that time till he was first seen, July, 1921. He said that the dizziness was worse in 1921 than it was in 1918; the attacks came on whenever he worked hard and were accompanied by palpitation and dyspnœa. The attacks were not spontaneous or nocturnal. Since his discharge from the army he claimed to have lost a day or two each week on account of vertigo during the time that he was employed. The attacks of vertigo came on when he first got up in the morning, so that he had to lie down again. During the remainder of the day he would have one or two other attacks, always when he was working hard and always accompanied by palpitation. He also complained of occasional dull frontal headache, radiating to the occipital region, tinnitus, bad taste in the mouth, occasional expectoration from the back of the throat, sometimes with blood, and gas in the stomach.

The family history was unsatisfactory; he had lost a sister with meningitis, and his parents, although living, were both sick.

The previous history showed that he had had from three to six attacks of bronchitis every year for several years and influenza, respiratory type, in 1918. He denied operations and injuries.

His habits did not reveal anything important; he smoked a few cigarettes; he had apparently used alcoholics freely while he was in France and Germany, but denied the use of any at the time of the examination. He seldom bathed and took no exercise.

The physical examination showed that he was sixteen pounds overweight; there were tremors in tongue and hands, but further than these no physical findings except those concerning the cardiovascular apparatus.

Cardiovascular Examinations (p. 201).

Wassermann reaction, negative.

Blood Examination.—Erythrocytes, 5,850,000; leucocytes, 8080; ratio, 1-724; hæmoglobin, 96 per cent. (Sahli); color index, 0.82.

Differential count:

Polymorphonuclear neutrophiles	61.6 per cent.	4977
Lymphocytes	34.0 per cent.	2747
Large mononuclears	2.8 per cent.	
Eosinophiles	1.2 per cent.	
Basophiles	0.4 per cent.	
Total	100.0 per cent	

Urine Examination.—A specimen passed at the time of the original examination showed a specific gravity of 1.028 and contained phosphates and carbonates.

Electrocardiographic Examination (Fig. 12).—Made by Dr. Harry D. Clough. No. 298, July 16, 1921. Tracing made with the patient lying in bed. Resistance, 500 ohms.

Lead I.—Average ventricular rate varies from 60 to 68 per minute, showing a slight sinus arrhythmia. The complexes are all uniform and normal. P-R

interval is normal, measuring 0.17 second. R-1 measures 10 mm. T-1 is positive and measures 2 mm.

Lead II.—The average ventricular rate is 60 per minute, although there is a slight sinus arrhythmia. The P-R interval is normal, 0.2 second. R-2 measures 14 mm. The T-wave is positive and measures 2.5 mm.

Lead III.—The average ventricular rate is 60 per minute, with a slight sinus arrhythmia. The P-R interval is normal, 0.2 second. The R-wave varies from 2 to 5 mm. in height, and shows marked notching in various parts of the deflection; sometimes on the up stroke; sometimes at the apex; sometimes on the down stroke. The T-wave is positive and measures 1 mm.

Diagnosis.—Sinus arrhythmia.

Note.—The R-T interval measures about 0.38 second in all three leads.

CASE 1365.—A man, aged 29 years, a railroad brakeman by occupation, was drafted in 1917 and assigned to the field artillery and later transferred to the engineers. While in training in the United States he was well. In the American Expeditionary Force he was in the St. Mihiel and Meuse-Argonne offensives, but was neither wounded nor gassed. In September he fell from a box-car and was told that he had sustained a rupture. He complained of precordial pain, dull and without radiation. He also complained of abdominal pain after being on his feet for an hour or so. He says that on one or two occasions he has tried to have his hernia operated on but has been refused on account of his heart, which physicians have told him is diseased. He has irregular frontal headache, palpitation, and complained of his left thigh feeling dead when he stepped on the left foot.

The family history showed a sister having died of diabetes, and the father of pneumonia.

The previous history was unsatisfactory; he made the claim that he had never consulted a physician in his life until he was in the army.

His habits showed an overuse of tea, six cups a day, and a corresponding diminution in water ingestion; he was a rather liberal user of tobacco, smoking 1⅞ ounces of pipe tobacco in two days, and bathing only once a week.

Physical Examination.—The man was forty-five pounds overweight, presented Dalrymple's sign, slight exophthalmus, tremor in the eyelids, chronic pharyngitis, moderate hypertrichosis, and exaggerated superficial reflexes.

Cardiovascular Examinations (p. 201).

Wassermann reaction, negative.

Blood Examination.—Erythrocytes, 5,140,000; leucocytes, 12,240; ratio, 1-442; hæmoglobin, 103 per cent. (Sahli); color index, 0.98.

Differential count:

Polymorphonuclear neutrophiles	57.2 per cent.	7001
Lymphocytes	28.6 per cent.	3500
Large mononuclears	9.2 per cent.	
Eosinophiles	3.6 per cent.	
Basophiles	1.4 per cent.	
Total	100.0 per cent.	

Urine Examination.—An examination of the urine made at the time of the first physical examination showed a high specific gravity and phosphates. A

CASE 1291—CARDIOVASCULAR EXAMINATIONS

Date	P.M.I.	Cardiac Dulness	Oblique Diameter Cardiac Dulness	Murmurs	Diastolic Sounds	Muscular Quality	Thrill	Unusual Pulsation	Pulse		Blood-pressure			Pulse	
									Corrigan	Capillary	Systolic	Diastolic	Pulse	Recumbent	Standing
7–5–21	4i, 8.0	3i, 5r, 2.5, 8.5	14	SD. m, base and apex max. 41i, tr. ensiform Recumbent same but louder. No change on exercise	P>A	N	—	—	?	—	132	52	80	76	94
8–10–21	5i, 7.5	3i, 5i, 2.5, 8.5	13.5	SD. m. 21i, max. 31i, not tr. Recumbent same murmur heard 2ri, and 4 li.	A>P	N	—	—	—	—	140	55	85	70	84

CASE 1365—CARDIOVASCULAR EXAMINATIONS

Date	P.M.I.	Cardiac Dulness	Oblique Diameter Cardiac Dulness	Murmurs	Diastolic Sounds	Muscular Quality	Thrill	Unusual Pulsation	Pulse		Blood-pressure			Pulse	
									Corrigan	Capillary	Systolic	Diastolic	Pulse	Recumbent	Standing
10–24–21	5i, 9.5	3i, 5i, 2.5, 9.5	15.5	D. m. apex; D. m. base; max. 31i, tr. 4i, not to ensiform, sometimes to apex. Heard in both recumbent and standing postures.	A>P	N	—	—	—	—	150	70	80	90	96
1–24–22	5i, 9.5	3i, 5i, 1.5, 9.5	15.5	SD. m. base, max. 31i. tr. apex and ensiform	P>A	N	—	General all over precordium	—	—	146	55	91	100	112

twenty-four-hour specimen showed a total quantity of 510 c.c., a specific gravity of 1.033, phosphates and amorphous urates.

Electrocardiographic Examination (Fig. 13).—Made by Dr. Harry D. Clough. No. 369, October 24, 1921. Tracing made with the patient lying in bed. Resistance, 1200 ohms.

Lead I.—The average ventricular rate is 91 per minute. There is a very slight sinus arrhythmia. The conduction time is normal, 0.16 second. R-1 averages 14.5 mm. T-1 is positive and measures 2.5 mm. The complexes are all uniform.

Lead II.—The average ventricular rate is 88 per minute and there is a slight sinus arrhythmia. The P-R interval is normal; 0.18 second. R-2 measures 22 mm.; T-2 is diphasic.

Lead III.—The average ventricular rate is 94 per minute, with a slight degree of sinus arrhythmia. The Q-wave is unusually prominent in this lead, measures 4 mm. R-3 averages 8 mm. in height. T-3 is definitely negative and averages 3 mm. in depth. The P-R interval is normal, 0.16 second. There is a noticeable thickening on the down stroke of the R-wave in this lead.

Diagnosis.—Simple tachycardia.

Surgical Examination.—Made by Dr. Charles W. Hennington. The man has a right inguinal hernia.

Röntgenologic Examination (Figs. 13 and 14).—Made by Dr. James M. Flynn. Diameter of the arch of the aorta, 5.3 cm. M-R diameter, 4.8 cm. M-L diameter, 11 cm. Transverse diameter, 15.8 cm.

Otolaryngological Examination.—Made by Dr. Edward S. Ingersoll. Ears, normal. Nose, low spur left. Adequate breathing space. Throat, chronically infected tonsils. Larynx, epiglottis thickened.

Diagnosis.—Chronic tonsillitis, tonsillectomy advised.

REFERENCES

[1] Bardeen: *Amer. Jour. Röntgenology*, 1917, 4, 604.
[2] Bret: *Arch. des. Mal. du Cœur*, 1919, 12, 494.
[3] Butler: *Jour. Amer. Med. Asso.*, 1920, 75, 1644.
[4] Fahr, Carter, Cosgrove, and Edgar: *Jour. Amer. Med. Assoc.*, 1919, 72, 162.
[5] Gallavardin: *Paris. Méd.*, July 2, 1921; Abstr., *Jour. Amer. Med. Assoc.*, 1921, 77, 820.
[6] Gittings and Smith: *Jour. Amer. Med. Assoc.*, 1919, 72, 917.
[7] Hirschfelder: "Diseases of the Heart and Aorta," 1910, 362.
[8] King: *Arch. Int. Med.*, 1919, 24, 89.
[9] Mackenzie: "Diseases of the Heart," 3 Ed., 1913, 393.
[10] Trémolieres and Caussade: *Bull. Soc. Méd. des Hôp.*, 1918, 42, 675; Abstr., *Jour. Amer. Med. Asso.*, 1918, 71, 1519.
[11] White: *Jour. Amer. Med. Assoc.*, 1921, 76, 162.
[12] Cotton: *Lancet*, 1919, 2, 470.
[13] Buchanan: *Arch. Int. Med.*, 1921, 28, 484.
[14] Lewis: "The Mechanism and Graphic Registration of the Heart Beat," 1920.
[15] Meakins: *Arch. Int. Med.*, 1919, 24, 489.
[16] White and Bock: *Amer. Jour. Med. Sci.*, 1918, 156, 17.

PHARMACEUTICAL RESEARCH

By H. V. ARNY, Ph.D.

Chairman, Research Committee, American Pharmaceutical Association, New York City

In discussing the subject of pharmaceutical research, a person not interested in pharmacy, or one who considers it solely as the retail purveying of medicaments, might ask the following questions:

(1) What is pharmaceutical research?

(2) Is not research along other scientific lines satisfactorily covering what pharmacists call pharmaceutical research?

(3) Is any pharmaceutical research being performed?

(4) Is research along pharmaceutical lines of sufficient merit to justify wider recognition?

Let me answer these questions to the best of my ability.

WHAT IS PHARMACEUTICAL RESEARCH?

Pharmaceutical research is, of course, research work with medicinal substances. Such research may be botanical, like that of Rusby who has made remarkable trips to South America searching for new drugs and studying the origin of well-known remedies; it may be chemical, such as the alkaloidal work of Schlotterbeck in this country and Schmidt in Germany; it may be physical, as the great work of Lloyd on percolation, filtration and adsorption; it may be phytochemical, such as the work of Kremers and his pupils on plants yielding volatile oils and on the structure of the oils so obtained; it may be micro-botanical such as the work of Kraemer on crude drugs; it may be purely pharmaceutical in the sense that it is concerned solely in the manufacture of medicinal preparations of attractive appearance and of standard quality; or it may be along a dozen other lines, where the study concerns medicinal substances.

IS NOT RESEARCH ALONG OTHER SCIENTIFIC LINES SATISFACTORILY COVERING WHAT PHARMACISTS CALL PHARMACEUTICAL RESEARCH?

As to whether other sciences cannot satisfactorily cover what we call pharmaceutical research, the situation resembles that obtaining in certain phases of medical research. There are of course some dis-

tinctly medical phases of research such as anatomy, pathology, therapeutics and surgery, but there are also a number of medical activities in which the primal research is along lines that might be considered pre-empted by other sciences. Thus modern physiology is largely chemical and yet no man would say that physiological research could best be done by chemists. These remarks can be directed with equal force to pharmaceutical research. Study of the proper manufacture of pharmaceutical preparations is, of course, a distinctly pharmaceutical field, and it might be said at this time that the reason why the Committee on Revision of the United States Pharmacopœia has become predominantly pharmaceutical is because our friends, the medical delegates, recognize that much of the revision work can best be done by pharmacists. On the other hand, research in pharmaceutical botany and pharmaceutical chemistry might be considered at first glance proper functions of either the botanists or the chemist. This idea, however, is fallacious. What we mean by a pharmaceutical botanist or pharmaceutical chemist is a person so thoroughly trained first in pharmacy and then in botany and in chemistry (the sequence of the last two dependent upon whether he is a pharmaceutical botanist or a pharmaceutical chemist) that he is capable of performing research work in the border land between these sciences with the ever present purpose of doing work that will be of service to medicine. Let me illustrate this by two examples. The great work of Schlotterbeck was the study of the rarer alkaloids of the *Papaveraceæ*. This work proceeded from the botanical standpoint, the study of genetic relationship, existing between various representatives of the poppy family, but it took Schlotterbeck far afield into a study of the structure of the papaveraceous alkaloids themselves, a field in which he proved his capability, thanks to his training in chemistry as well as in botany.

Then there is Kremers' great work in phyto-chemistry. Trained first as a pharmacist and as chemist, he studied the chemistry and the practical application of volatile oils, but this work has led him more than once to the botanical side of the problem; notably to the cultivation of those American plants that yield volatile oils. In short, Kremers is not merely a trained chemist; he is also a trained botanist.

Turning a moment to research of strictly pharmaceutical char-

acter, it should be stated that great work in this direction has been performed and that much remains to be done. Thus the distinctly pharmaceutical task of percolation, the extraction of soluble principles from a drug by the passage of a suitable menstrum through it, presents deeply interesting problems involving physics as well as pharmacy. In a recent paper on the subject of percolation Couch gave a bibliography citing 204 papers reporting research along the lines of percolation.

Some non-pharmaceutical scientists sneer at research in improving recipes for pharmaceutical preparations. Yet there is little research work of greater value than that performed by the thirty-three pharmaceutical members of the U. S. P. Revision Committee in studying improvements in the pharmacopœial recipes, to say nothing of work of similar merit and value performed by the fifteen revisers of the National Formulary. These problems are by no means simple. Thus during the past three years Scoville has worked on a single problem, the proper solvent for extracting cinchona in a suitable manner.

IS ANY PHARMACEUTICAL RESEARCH BEING PERFORMED?

I can best answer the third question by referring to an address delivered in 1920 before the Pennsylvania Pharmaceutical Association,[1] in which a roll of honor of forty-seven workers is given. Taking up the work of the past as well as the present, I will here only cite Scheele, the Swedish pharmacist, who discovered the fruit acids as well as the element chlorine; Serturner, the apothecary of Eimbeck, who isolated morphine, the first discovered alkaloid; Pelletier and Caventou, *pharmaciens* of Paris, discoverers of quinine and other cinchona alkaloids; Procter, "the Father of American Pharmacy," whose research work included the development of the art of percolation, the manufacture of elegant pharmaceuticals and the study of the constituents of crude drugs; Squibb, the great manufacturer whose study of percolation is a classic; Lloyd, another manufacturer, whose work on capillarity and adsorption is now cited by physical chemists as pioneer work along these lines; and thus unto the present time, when those investigators cited upon a preceding page are performing work of vast credit to science as a whole and to pharmacy in particular.

[1] *J. Am. Pharm. Assoc.*, 9, (1920), 684.

No better answer to the question: "What research work is being done by pharmacists?" than the bare statement that at the 1922 meeting of the Scientific Section of the American Pharmaceutical Association over eighty papers were presented by their authors.

IS RESEARCH ALONG PHARMACEUTICAL LINES OF SUFFICIENT MERIT TO JUSTIFY WIDE RECOGNITION?

Turning to the fourth query, the answer should be an emphatic "Yes." Despite the propaganda of the advocates of drugless therapy and of treatment with antitoxins and other biological products, the administration of time honored medicaments still obtains. Despite intravenous medication and pellet dispensing, there is still a demand for medicines dispensed in the form of elegant pharmaceuticals. We who are on the shady side of fifty can well shudder at the thought of the nauseous doses of our childhood, and pharmaceutical America in its half-century work of supplying the physician with attractive preparations instead of the old-time distasteful mixtures has performed a distinct service to American medicine; a service performed under extremely discouraging conditions.

Again in pharmaceutical research as in all other research, work performed in a narrow field may develop into dimensions undreamed of by the investigator. Already mention has been made of the work performed by Lloyd thirty years ago as a problem in pharmacy, which is now recognized by physical chemists as pioneer work in the field of adsorption. Again the physical chemists have taken the older pharmaceutical work on emulsions and have developed it into some of the most successful applications of colloidal chemistry to manufacturing problems. When one considers the vast sums that have been devoted during the past score of years to chemical and medical research, the money now available for pharmaceutical research seems a pitiful sum. But the research workers in pharmacy are not discouraged. They realize that their work is of service to mankind. They further believe that when recently established agencies for the transmission of information concerning pharmaceutical research are in full operation, the public will eventually realize the debt the world owes to pharmaceutical research.

THE THERAPEUTICS OF THE PSYCHONEUROSES

By JAMES J. WALSH, M.D., Ph.D., Sc.D.

Professor of Physiological Psychology, Cathedral College, New York, and at Marywood College, Scranton, Pa.; Extension Professor, Fordham University, New York City

The most interesting announcement in therapeutics during the past year has undoubtedly been that which came from the clinic of M. Coué, at Nancy, in France. M. Coué is a chemist who became very much interested in suggesting to people that they could feel better if they wanted to, and then proceeded to use this as a mode of treatment. He takes no money for his services, though I understand that some grateful patients, cured of ills of long standing that had proved extremely annoying and some of which had made ordinary occupations impossible, have established a foundation which enables M. Coué to devote himself to the treatment of patients of all kinds by his method. The patients, it may be said, now flock to him by the thousands. M. Coué insists that he does not cure them, but he teaches them how to cure themselves. His mode of treatment has attracted a great deal of attention in France as well as in England, where he went to deliver a series of lectures and to give a number of demonstrations, and I believe that it is understood now that he is going to come to this country to deliver a series of lectures and to give the benefit of his experience in curing chronic ills of many kinds, and especially those which have made the round of a number of physicians without being relieved.

His method of cure is simplicity itself. He has the patients say a number of times a day, "I am getting better." And then, strange though it may seem, they proceed to get better. M. Coué has even invented a regular formula for it. In the early morning as soon as the patients awake, indeed, before they are quite roused into complete wakefulness, those who are under his care and expect to be helped by him are to begin to say, "Every day in every way I am getting better and better." One of his translators has suggested the variant of the formula, "Day by day in every way I am getting better and better," but that does not seem to translate the French quite

so well and the rhythm of it is not quite so good. In some suitable form this set of words is to be repeated a number of times. M. Coué has even suggested that the patient should have a string in which he makes a dozen to twenty knots and then he should run these through his fingers somewhat in the way that a rosary is used, repeating the formula at every knot. Besides this, there should be a repetition of the same suggestive formula at other times during the day. This should be done not hurriedly, in between other occupations, but at moments when the patient is resting quietly, especially if he is in a somewhat dreamy state; if for instance, when reading the paper there should be a tendency to sleepiness, then the formula should be repeated. Of course, just before going to sleep at night, there should be a regular repetition of the formula so as to compose oneself properly to rest in the most favorably suggestive state of mind possible.

Such a mode of treatment as a serious contribution to therapeutics would seem to most people to be so trivial, indeed almost childish, as to be more or less ridiculous. It is almost like mother saying to the little one who has hurt itself, "Come and let mother kiss it, and it will be well." The whole process might very well be compared to the nurse's saying to a child when it falls, "There, now, I will bet you have hurt the floor," and thus distracting its attention from its injury and so making it forget about its own hurt until the discomfort due to it has passed off or at least has lessened. Surely this sort of thing cannot be practised successfully on grown-up people who have been suffering from some ailment for a long time and many of whom have perhaps made the rounds to a series of physicians without being benefited. Children hurt themselves but slightly, as a rule, and have only passing discomfort which can be readily dispelled simply by concentrating their attention on something else and then telling them it is better, but surely adults who have sense, and many of whom indeed are well educated, or at least have had all the advantages of our facilities for education, cannot be made to forget their ills by any such childish means as this. Imaginary ills may be cured by means of the imagination, but the real ills of humanity that have made people miserable for years, and have kept them from their employment when they wanted very much to be employed and

indeed often needed very badly the remuneration from their occupation, cannot be cured simply by telling them to go away, as the child tells the rain to "go away and come back some other day."

And yet all the reports show that M. Coué is very successful in bringing about the cure of those who come to him. One of his enthusiastic disciples who, having been cured himself, has followed the work carefully ever since, declared that 97 per cent. of all those who make their way to Nancy and put themselves under the master's ministrations are relieved. It has been declared that more than 60 per cent. of all the patients who go there are *cured* of their ills. They drop from them as if by magic. Many of them have been sufferers for years. Not a few of them have been almost helpless before making their pilgrimage to Nancy, for it is not merely the vague complaints of the neurotics and hypochondriacs, those who have queer feelings about their head or palpitation of their heart or indefinite discomfort in their abdomen who are relieved by M. Coué's method. It is above all those who have painful and disabling conditions in their arms and legs which often made it impossible for them to execute certain movements who are most successfully treated. The lame and the halt, the stooped, the crippled of various kinds are straightened out and are made capable of using their muscles as they did before their ailment developed, or at least are made so much more comfortable in their use of muscles that they leave Nancy perfectly convinced that it is only a question of a comparatively short time until they will be able to do without any trace of pain many things which have been very painful for them to do for weeks or months or at times even years. As a matter of fact, most of them report themselves later as completely relieved of the ills for which they applied to M. Coué for direction—for he prefers not to speak of his method as cure.

It is extremely interesting to have the report of a therapeutic movement of this kind developing in Nancy because it recalls a preceding chapter in therapeutics in the generation just before ours, the principal seat of which was also in Nancy. For it was in this French town that Professor Bernheim some forty years ago called attention once again to the therapeutic value of hypnotism for a great many of the ills of mankind. Bernheim's attention had been

attracted to the employment and value of hypnotism because of a case for which he had been unable to do anything effective, though he had exhausted, as he thought, the regular therapeutic armamentarium in its treatment, and then it had been cured by hypnotism. The story as Professor Bernheim used to tell it was about as follows: There was a patient in his clinic suffering from lumbago and quite unable to walk straight. He stooped rather badly and besides he could walk but very slowly, held his back very rigid, avoiding all jars and sudden movements very carefully, so that he had been quite unable for months to go on with his occupation. Bernheim had tried everything known to medicine at that time without the slightest success. The patient had been out in a severe rain storm, had got thoroughly wet through, had had to ride for some distance on a rather windy day without being able to change his clothes, had been wakened the next morning by a stabbing pain in his back, such as the Germans, and Nancy is not far from the German border, are accustomed to call *Hexenschuss,* or "the witch's shot." In the old days this sudden pain used to be said to be due to the fact that some witch who had a grudge against you or who had been effectively appealed to by someone who had a grudge against you, had stuck a pin in the back of a waxen image supposed to represent you, and then wished the injury over on you with the result that you woke crippled. No wonder that once it began it was so hard to get rid of.

After some months of treatment by rubbing, massage, the application of various counter irritants, even the use of a flat iron properly heated, applied to a flannel stretched over the region, the use of the actual cautery as well as dry cupping and wet cupping, the patient was no better. Then Bernheim missed him from the clinic, but was naturally not much surprised because they had done him apparently no good. Some months later he met the man on the street walking perfectly erect and evidently entirely recovered. He asked him what had done him good and the patient was quite willing to tell him that he had gone to Doctor Liebault and been cured by hypnotism. Liebault used to put his patients into the hypnotic sleep, suggest to them that they were going to get better and then have them wear a piece of writing paper over the part in which they suffered and a great many of them proceeded to get better. This patient had worn

a large sheet of legal cap over his lumbar region in between the hypnotic seances and now was entirely well.

This attracted Bernheim's attention to hypnotism and he took it up and found that he could cure a great many cases which had resisted treatment of other kinds before. He published the account of his successes and this attracted Charcot's attention and the great Parisian specialist took up the investigation of hypnotism which brought the whole matter to the attention of the medical world at that time. Then Dumaurier wrote his book, "Trilby," and everybody became interested in hypnotism and above all, just as has happened with psycho-analysis now, hypnotism became the fashion among literary folk and university people, and various terms borrowed from hypnotism became the fad of the hour. It was discussed in drawing-rooms and in clubs and the professors of psychology took it up and anyone who did not know all about hypnotism was not in the swim and was looked upon as really being very much behind the age.

It was sincerely hoped, indeed expected, that hypnotism would solve a great many problems in psychology and unlock some of the mysteries of telepathy and very probably also of clairvoyance and clairaudience and prove a veritable God-send for the cure of all sorts of ills which had resisted every effort of physicians before. It was declared that it would cure drug addictions and inebriety and bad habits of all kinds, and it was even thought that criminals could be hypnotised into being better men and women and that indeed it was only a question of time until a veritable reformation of mankind would be worked by the beneficent activity of this mode of action upon the mind which now was being properly used for the first time. It is most amusing to look back now and see how much was expected of hypnotism. People actually took Dumaurier's book, "Trilby," quite seriously. They felt that it would be perfectly possible for somebody with very strong hypnotic powers to produce in some utterly unmusical person a positive genius for music or to evoke from one with the cacophonous voice of Trilby O'Farrell the divine cadences of a great opera singer.

As for therapeutic power, it seemed for a time as though there might be no end to it. I remember hearing a distinguished professor

of psychology after demonstrating a young girl in a hypnotic trance (just for exhibit purposes!) declare that he could, by hypnotic suggestion, change the whole character of an individual. He told us that he had under observation at the time a man who was addicted to drink and who was ruining his health and his business and making his family intensely miserable by his habits of inebriety, and that if he wished he did not doubt that he could by hypnotic suggestion absolutely break that man of his habit, but that he did not feel justified to do so. "After all, the man had free will," he said, "and had never asked himself that he should be thus cured of his liquor habit and no one had the right to intrude on his personality and rob him of his voluntary power by putting deep into his mind suggestions that would surely work their way and compel him to do what they demanded rather than what he himself cared for."

Hypnotism and the hearty commendation of devotees worked wonders of cures. A great many people were cured of pains and aches of various kinds, headaches and neuralgias, pains in the back and shoulders, and many were relieved of disabilities. Many a person who could not lift his or her hand to their head after having been put into a hypnotic trance and given the suggestion that they could accomplish this, were able after coming out of their hypnotism, to do so without pain. Many a person who walked lame, and especially those who had had some injury weeks or months, or perhaps several years before, and had been carrying a cane or perhaps even a crutch, ever since, were able to drop the crutch or the cane and walk erect after an hypnotic suggestion to that effect. Of course, as for the psychoneurotic conditions, the tremors and muscular disabilities consequent upon hysteria, they were relieved marvelously by hypnotism. Some people who had been bed-ridden and who had to be brought to Nancy to Bernheim's clinic in an ambulance, or who had been so paralyzed, or at least unable to use their limbs, that they had come in wheel chairs, were hypnotized back to health. And the fame of it all went abroad and Nancy became a Mecca for people from all over the world, that is, at least members of the idle rich class whose doctors had never been able to understand them and who knew that this new therapeutic with its mysterious power would surely do them good—and of course it did.

Down in Paris, Doctor Luys got even more wonderful results, for he found that when patients had become real hypnotic subjects, thoroughly susceptible to the influence of this new psychic aid to therapeutics, all that was necessary was for them to hold a bottle of medicine in their hands and then in the hypnotic condition they would feel all the effects of the drug. A dose of morphine would set people to sleep thus without the necessity of disturbing their internal economy by its administration by the mouth, or hypodermically. Even laxatives could be administered that way and could be controlled thus much better than when given in the ordinary way. Dr. Ernest Hart, the editor of the *British Medical Journal,* exposed these procedures and showed that Doctor Luys' hypnotic subjects were working him for a nice living in the hospital with nothing to do in the winter time, in the meantime reaping a rich harvest from the tips given by visiting physicians from all over the world who came to see the wonders of this new therapeutic mode. That gave hypnotism a very bad black eye and it was not long before it began to disappear; by the time the twentieth century was well under way it was rather thoroughly discredited and only a few quacks and some charlatanish physicians still employed it.

Now we know what hypnotism is, only we first had to learn what hysteria is before we could understand it. For hysteria, until a few years ago, the only definitions we had were descriptive and they said nothing about the essence of the disease. Now we have what is very probably an essential definition of the affection. That definition can be given in a single word, though the word is rather long: hysteria is super-suggestibility, that is, an abnormal tendency to take suggestions. As the result of the war we know that men are just as liable to it as women. If anyone had said before the last great war that the neurologists would be even more important for the care of the soldiers under arms than the general physician and only second in significance to the surgeon, the idea would have seemed preposterous. All that we expected was that the neurologist would have to guide the surgeon in his operative procedures upon peripheral nerves in the central nervous system when these were wounded by bullets or other missiles. That a great many soldiers would suffer from hysteria seemed quite out of the question. Many thousands

of beds, however, had to be maintained for the sufferers from hysteria in the allied armies, though also in the German armies. "Shell shock" was just old-fashioned hysteria and it was four times as common among the officers in proportion to their numbers, that is, among the educated men in the army, as among the rank and file. We are making people more susceptible to suggestion and also to hysteria by educating them.

Hypnotism is induced hysteria, that is, induced super-suggestibility. We have known for years that there was no question of hypnotism representing anything like the passage of some force from the operator or hypnotizer to the subject. The conditon was produced entirely within the subject by the concentration of his attention on what was suggested by the hypnotizer.

We were using induced super-suggestibility, that is, hypnotism, to cure idiopathic super-suggestibility.

It comes with a certain appropriateness, however, that now that a new therapeutic mode is introduced the home of it once more should be Nancy. M. Coué has reduced suggestion to its lowest terms. He not only does not believe in hypnotism but condemns it rather severely. He wants his patients to catch themselves in susceptible mood and then give themselves suggestions that will find their way into their subconsciousness and prove curative. He does not want them to use their wills. He does not hesitate to say that whenever the will and the imagination of the patient come into conflict the imagination always gains the victory. You must not try to make yourself well just through will-power, nor to insist upon being well, but you must just keep on telling yourself that you are going to get better and then after a time you will get better. The important element in the treatment, however, is to have the suggestion steal gradually into your subconsciousness, find a resting place there, and from there work to overcome the unfavorable suggestions that you have been giving yourself for years perhaps, and when these are overcome, you will be well. M. Coué has illustrated this in a series of cases that are now very well known because they have been published broadcast and are quoted by all those who want to impress people with the import of the new therapeutic method.

For instance, a blacksmith came to M. Coué to be treated for

an inability to raise his right arm which had developed in connection with his occupation and which had finally made it impossible for the man to lift his hand as high as his head and of course put it entirely out of the question for him to go on with his employment as a blacksmith. M. Coué said to him, "You have been saying to yourself for years, 'I cannot lift my right arm, I cannot lift my right arm, I cannot lift my right arm,' but now I want you to say with me, 'I can lift my right arm, I can *lift* my right arm, I CAN lift my right arm,' " and then he added at once, "Now lift it," and sure enough without any trouble the man's hand went up in the air, though he had not been able to lift it that way for a long time. He was cured. After only a little exercise of his arm he was able to go on with his occupation and it is easy to understand how he blessed the man who had thus enabled him to overcome an affection which had crippled him for so long and for which the physicians whom he consulted had been quite unable to do anything. He was supposed to have a crippling neuritis, he was suffering, however, only from a neurosis, but this had absolutely inhibited his power to raise his arm and so had made a sufferer of him and one absolutely without the capacity to go on with his work. Originally, without doubt, his affection had been a neuritis, but that had long since run its course, but the neurosis had developed from dread of using his muscles while they were painful and now that needed to be cured.

Such cases of neurosis are much commoner than has been thought. Their history often runs like this. A man injures his knee or his elbow or his shoulder, or a woman injures her back or falls down stairs and acquires some black and blue marks and hurts her "spine," or sits down hard on an icy sidewalk and injures her coccyx. Not infrequently the injury itself proceeds to get better and the patient regains the use of the muscles that have been out of commission to some extent, at least, and then several weeks later, or a month, muscles in that region begin to give trouble again and before long there is a development that cripples, gives pain on movement, and this state of discomfort and disability may last for a long time. Such conditions have been cured by the application of magnets in the older time, by hypnotism in the nineteenth century, Dowie's touch or the hem of Schlatter's coat in the early twentieth century,

or by osteopathy or chiropraxy in our day, or by anything else under the sun that will change the attitude of the patient's mind toward that set of muscles. Such cures, however, are very striking. Men have been walking with bent backs or lame legs, or have been known to have lame arms and have been out of their regular occupation for a long time, and then they are "cured." No wonder that everybody who knew them while ill wants to know what it is that has cured them and is ready to think that whatever it is must represent a great new development of therapeutics, for "by their fruits ye shall know them," and this produces good fruit of the cure of long-standing ills.

M. Coué works wonders particularly in the curing of pains and aches of various kinds. When people have pains in their head, for instance, he strokes them gently and says, "Now the pain is going, it is going, it is going," and then, as his fingers get toward the chin, he draws his hand away and says, "It is gone." Or the same procedure is gone through with for a pain in the shoulder or the arm, the pain being induced, as it were, to make its exit at the end of the fingers.

It is very curious how all these therapeutic methods cure particularly the pains and aches of humanity and the disabilities of various kinds. Ordinarily it is presumed that when something cures pain it must be a very real physical remedy and when it relieves crippling, of course it must represent something that has a very powerful action upon the body-tissues. And yet all down the centuries, from the time when little Leyden jars were carried around Europe shortly after the invention of that rather startling electrical device, through ever so many other curative modes, magnets, Mesmer's fake battery, Perkins' tractors supposed to be electrical but without any electricity in them, men suffering from pains and aches and disabilities, the maimed and the halt and the agonizing have been cured and their cures have provided the strongest kind of testimony (presumably!) to the value of these modes of treatment.

M. Coué and some of his ardent followers are quite sure that he can cure tumors and ulcers and even cancer and various other surgical lesions. Of course, M. Coué himself says that he does not cure people, but that he shows them how to cure themselves. Almost needless to say, the cures of cancer and tumor and other organic

conditions are not real but are examples of mistakes of diagnoses. M. Coué does not pretend to be a trained diagnostician himself, indeed he makes no pretense at being a physician. He accepts the diagnosis that the patients bring him. We physicians are likely to see any number of patients who are suffering from all sorts of serious organic disease if we were to believe the accounts they bring us. Especially as regards tumors and ulcers; the patient himself, and still more herself, is a very untrustworthy reporter of the diagnosis that has been made in their cases. Possibly some physician has suggested the remote possibility that some of their symptoms might indicate that they were sufferers from tumor or ulcer, and this dread possibility comes to occupy a central place, a true focal point in the consciousness of these patients, until they are quite ready to persuade themselves that the physician has told them that this is what is the real cause of their symptoms.

There is a wonderful lesson in M. Coué's work. He is curing thousands of people every year and relieving thousands of others of conditions that have sometimes made them miserable for years. He is doing it simply by changing their attitude of mind toward their pains and aches from one of discouragement and unfavorable suggestion as to their endurance to one of courage and the feeling that these troublesome conditions will disappear. Probably all of them are benefited in some striking way. It is sometimes the custom to say that such people are suffering from imaginary ills and that of course they can only be cured by their imaginations, and M. Coué does not hesitate to use that word imagination. As a matter of fact, however, people rarely suffer from imaginary ills unless they have some mental trouble. There is an abundance of imaginary ills to be seen in insane asylums. Almost without exception, however, those who are outside of insane asylums have some real physical ailment, though it is often of no serious significance, and sometimes is of almost trivial character. But they dwell on it, concentrate attention on it, exaggerate its significance by the law of avalanche because all the cells of the brain underlying consciousness become occupied with it and thus multiply its tormenting power and besides their attention enlarges the blood-vessels in the part where the suffering is and makes

the peripheral nerve endings there ever so much more sensitive than they were before.

Anyone who can bring about a change in their mental attitude will greatly relieve and perhaps, after normal living has proceeded for some time, completely cure such patients. A great French clinician once said that he thought that something like 60 per cent. of all the people who came to his office on their own feet, that is, the ambulatory patients of his practice, were suffering more from dreads than anything else. Most of them had some slight physical ailment. All of them had some definite physical reason for thinking that they were ill, but the main reason for their symptoms was that they were so afraid that something serious was developing in them that they were inhibiting their own vital energies and not infrequently seriously interfering with normal living. Their fears made them eat less than they ought to, or kept them from eating many things that would be good for them, very often kept them from exercising properly or led them to form unfortunate habits of various kinds. Not a few of them were resting too much because of their dread of what was the matter with them, and rest is the most dangerous remedy we have, at least as dangerous as opium, an extremely valuable remedy when properly used, but very easily prone to do harm unless it is prescribed and taken properly.

It is people suffering from dreads in this way who develop all sorts of symptoms. Take the example of the men suffering from "shell shock" during the war. They presented the most varied pictures. A certain number of them had some mental symptom as the most prominent feature of their affection, but most of them had a whole series of physical manifestations. Some of them could not walk, some of them were lame, some had tremors, many of them had vague internal discomforts that kept them from nourishing themselves properly, most of them were interfering sadly with the exercise they ought to take, and this lack of regular life disturbed their sleep or made it very difficult for them to sleep regularly, and so there was a vicious circle of influences often extremely hard to break.

We are constantly hearing about new cures for these conditions. There is some new mode of treatment for them invented at least every week. Nearly every drug under the sun has at some time or other

been hailed as a life saver because it has cured some of these people. Think of all the Americans who used to be cured by sarsaparilla and the other bitter tonics that we found after a time to consist of practically nothing but bad whiskey. All sorts of people had been cured, as the testimonials showed, by these remedies, sometimes of affections that had lasted for a long while and had defied the best efforts of physicians. The "cured" patients were not infrequently clergymen, sometimes they were lawyers and judges, sometimes they were members of the legislature or even of congress. They evidently felt they had been cured, and they undoubtedly were, but not of anything that was the matter with their body—bad whiskey does not cure bodily ills—but of something that was the matter with their minds. They had a wrong attitude of mind toward themselves and nothing would cure them until this was changed. Anything that would alter this fundamentally would cure them.

That is the reason why we have so many cures in our time. Prof. John Dewey, of Columbia University, one of the most thoughtful educators in America, in a brief article on education the other day said that he thought that he would agree with Matthew Arnold and French educators that "the chief advantage of education is the assurance it gives of not being duped," or, as he prefers to put it more positively, "The profit of education is the ability it gives to discriminate, to make distinctions that penetrate below the surface." He adds, however, at the beginning of the next paragraph, that, "Judged by this criterion, education is not only backward in this country, but it is retrograding. This is the era of bunk and hokum—there is more of it in quantity, its circulation is more rapid and ceaseless, it is swallowed more eagerly and more indiscriminately than ever before."

Just in the same way drugs are swallowed more than ever and curious notions of all kinds are accepted that cure people. M. Coué is curing them by the thousand every year simply by telling them to say to themselves, "Every day in every way I am getting better and better." Most of them have been engaged for years in saying to themselves, "Every day in every way I am getting worse and worse." Just to get them to say the opposite and keep saying it, to say it without arguing, to refuse to admit other ideas, to let it

steal into the consciousness and find a place there, to keep on suggesting, this and nothing more to them is enough to cure them. The very word suggestion is interesting. It comes from the Latin words *sub* and *gero,* which mean to carry under. It represents an idea that gets into the mind by coming under the usual barrier of reasoning and escapes the scrutiny, that tendency to negativism so prone to exist in mankind from its earliest years. Once it finds a place in the mind, it acts much more energetically to influence thought than many of the reasoned conclusions at which we arrive after much mental labor. The fact of the matter is we do not trust our reason very much, but ideas that get seated in our mind in any way without reasoning and get a firm hold there will often affect us deeply. This is what M. Coué does with his method of repetition of favorable suggestions as to health.

His success as a healer is extremely interesting in our time and his coming to America ought to emphasize the lesson of his work. We need it just now. We have all sorts of cures around us, all sorts of healers. It is interesting to pick up one of the New York papers on Saturday and read all the announcements of what are called "religious services" that are going to be held the next day in the metropolis of this country. New York likes to lay the flattering unction to its soul that it is the intellectual as well as the social and numerical mother city, to translate the Greek word metropolis, of the country. A number of the most prominent hotels and an equally large number of the theatres are used every Sunday for the propagation of the ideas of healers of various kinds. You are invited to come to one hotel to learn how to regain your health and make money. You are invited to come to a neighboring theatre for "audible healing," and there will be a demonstration of cures at the end of the lecture. A very kindly invitation is extended to come and have your health renewed by New Thought and getting in tune with the infinite. You are respectfully asked to come and be made a better man or woman physically, intellectually and for business purposes by psychological analysis. There is metaphysical healing and psychoanalytic healing and psychological healing and spiritual healing and spiritualistic healing and spiritistic healing, all to be

had by anyone who wants to apply at the fountain heads of these various mystic cults of healing.

Is it any wonder that Prof. John Dewey said that this is the era of bunk and hokum?—and we in medicine have lots of it. M. Coué, however, makes no pretense. He has reduced suggestive healing absolutely to its lowest terms. He tells you that you have the power within yourself to cure yourself, but go and do it by changing your attitude of mind toward yourself. He does not pretend to find something wrong with your spine and does not proceed to make fancied adjustments of your organs and then say, "Now you must go and get better because I have fixed you up and there is nothing any more the matter with you." He does not administer a series of glands, about which we know almost nothing, for a series of symptoms of which we know, if possible, less, and then claim the credit of the cure when patients happen to get better. Does anyone think for a moment that we know enough about glands to use them in the way that some people are prescribing them at the present time and announcing their cures? They, too, are curing this 60 per cent. of ambulatory patients who have vague symptoms the matter with them, mainly due to the dreads that they are cultivating. This is the body of patients that has made it so hard to discriminate between cures that are real and cures that are merely due to a change of mental attitude on the part of the patient.

M. Coué has, I believe, cured a number of patients who had been cured by psychoanalysis and then had, as so often proves to be the case, relapsed after a time. He has even cured a number of patients whom the psychoanalysts had refused to treat any more because they were beyond forty, and psychoanalysis could scarcely be expected to do them good any more. He should have a great field in this country because chiropractors are finding an immense number of patients who are benefited by their ministrations. As it is perfectly possible to get a chiropractic diploma after a few months of training or even less than that if one has some pull and some money, I understand, and as a good many of these hasty-pudding healers are making a good living, what an immense choice of sufferers Coué will have who will doubtless prove excellent material for his demonstrations.

Unless the medical profession is going to realize the place

that the psychoneurosis, that is, the influence of the mind on the nervous system, has in producing symptoms and complaints and even pains and aches and disabilities, we shall continue to have in America, as we have at the present time, an extremely fertile field for healers of all kinds. There is no use arguing with these patients. Reasoning will not help them. You cannot persuade them that it is just a mistaken attitude of mind that they have. Coué's work, and his very interesting success, is making that very clear. You must get a suggestion into their minds in some effective way. We of the medical profession have done this in the past by employing some physical means which we thought efficacious and putting the suggestion with it. After a while the physical means proved to be absolutely useless and then we gave up its employment, but took up the next fad of treatment, whatever it was. Why not let the lesson of Coué's work mean something to us in the great field of therapeutics? He cannot cure the organic diseases and, as a rule, neither can we, but he can cure the psychoneuroses, and they constitute the basis of a large number of affections that are making people very miserable and then they complicate many organic affections and the cure of them, even when the organic ailment remains, will make the patient ever so much more comfortable and make him very often capable of doing his work or at least taking up some occupation, and that of itself will lessen a great many of his other symptoms.

The therapeutics of the psychoneuroses, mainly through a definite alteration of the mind of the patient, is the key to the mystery of modern healing. We used to use alteratives in medicine, they were very mysterious drugs that worked wonders for us. The supreme alterative, however, always a wonder working in healing is that which will make a change in the patient's mind toward himself; put favorable suggestions into his consciousness and set him thinking that he is getting better from day to day and not getting worse, finally will lead to his cure even though a great many physical remedial measures have been tried and failed.

Pædiatrics

POLYGLANDULAR DEFICIENCY, WITH HYPERGLYCÆMIA*

By IRVING PARDEE, M.D.

Physician to the Neurological Institute; Attending Neurologist to the City Hospital; Chief of the Clinic for Neuro-endocrinology, Neurological Institute; Neurologist to St. Mary's Children's Hospital and to the Out-patient Department of St. Luke's Hospital, New York City

THIS patient had a normal birth and was bottle fed. At the age of one year she had her first tooth. At the age of four years she walked and talked. At the age of five and one-half she was referred to an oculist for crossed eyes. At this time she also had a speech defect. She was backward in her mental development, having been left down in one grade in school for three years. She was a masturbator until 13 years of age. She was not only mentally backward, but stole small amounts of money at various times, and on one occasion stole $50 from her mother. She was also accused of taking things at school. She is employed as a nurse girl and is very fond of children. Menstruation began at the age of 12 years, was irregular, scanty and accompanied by some pain. At these times she was extremely easily fatigued and easily disturbed emotionally. Several months ago before her menstrual period she became so irritated and enraged that she struck a child with a milk bottle. She complained of frequent frontal headaches.

The patient's family history is important in that both of her parents are alcoholic, and the father has been a diabetic for twenty years.

The girl is now 17 years of age, and has the intellectuality by the Terman test of a child of eight years, which places her in the low moron group. She is short, obese, has a large head; her eyes are close together; her teeth somewhat spaced. The conformation of her hand is characteristic of the hypopituitary type of hand, being

* Patient shown before the Section on Pædiatrics, New York Academy of Medicine, May 11, 1922.

wide, fatty and chubby, short tapering fingers and quite diagnostic in itself. Her joints are lax and show hyperextension. She is flat footed. Her secondary sexual characteristics are well developed.

The laboratory examinations made routinely show some rather surprising findings. The urine was negative throughout, and contained no sugar. The blood sugar was 330 mgs. per 100 c.c. of blood. Blood sugar curve showed 263 mgs. sugar before the test and one hour after taking the glucose she showed 322 mgs.; three hours after taking the glucose she showed a blood sugar of 318 mgs. The X-ray pictures of the skull show a sella turcica which is rather small and somewhat enclosed, indicating that she has a sella turcica which cannot hold a pituitary which is large.

On the strength of the physical findings, the laboratory examinations and the X-ray findings, the patient was put on a restricted diet and given pituitary gland extract and corpus luteum extract. Since this medication she has made a decided improvement. Her headaches have disappeared. Her menses, which were painful, pass off without pain or discomfort, and the psychic disorders have improved. Although her March period was ten days late there were no symptoms and no abnormal behavior. Pituitary gland extract was given in doses of one grain a day and in the centre of the menstrual cycle corpus luteum was given in addition. Under this treatment the blood sugar dropped from 330 mgs. to 90 mgs. in March. When estimated again to-day we found that it had risen to 285. I think if we make an inquiry we shall find that she has been taking too many ice cream sodas.

To summarize: The girl shows the physical abnormalities of a hypopituitary type, and menstrual difficulties, disturbed sugar tolerance, and mental deficiency with emotional instability are closely related to this syndrome. Gonadal insufficiency and thyroid underactivity are also indicated by the symptomatology and show the polyglandular nature of the disorder.

A CASE OF AMAUROTIC FAMILY IDIOCY WITH SYMPTOMS SIMULATING TETANY*

By A. G. DE SANCTIS, M.D.

Attending Pædiatrician to the Post-Graduate Hospital, New York City

Joseph B., 2 years 9 months of age, came under observation at the Post-graduate Children's Clinic on November 23, 1921, being about two years old at that time.

Family History.—The patient was of Jewish nationality. The history was negative for tuberculosis and syphilis. There was one other child, 5 years of age, apparently normal. At the time of the patient's birth the mother was 32 years of age; the father, 29.

Birth History.—The child was born at full term; normal labor lasting two hours; non-instrumental delivery; no asphyxia; birth weight, eight pounds.

Previous History.—Negative for any of the contagious diseases. The child was breast fed for 14 months, then given a cows' milk formula; no solid food was given at any time as the child had great difficulty in swallowing anything but liquids. The child's development was apparently normal at birth. He first held up his head at the age of eight months, never sat alone or talked; the first tooth appeared at fifteen months.

Present History.—When the child was one year old the mother first noticed that he became indifferent to his surroundings, would not play with his toys, lost the power to hold things in his hands and became very irritable so that he would start at the least sound; he also began losing weight. Soon after this the child had a high temperature and convulsions. He was taken to the hospital where he remained for three days. From that time he had what his mother called "spells." Her description of one of these attacks was that the child would suddenly become very rigid, the hands and feet becoming stiff and assuming a peculiar position. The attack would last two or three minutes. He was having at that time two or

* Remarks made before the Section on Pædiatrics, New York Academy of Medicine, May 11, 1922.

three attacks daily. These increased in frequency and severity until at the end of the second year, when he was constantly in a spastic condition.

Physical Examination.—When first seen the child was markedly emaciated, weighing 15 pounds; was spastic; showed marked opisthotonos; skin was dry and loose; no cyanosis. Examination of the head showed prominent frontal and parietal bones; anterior fontanel closed; internal strabismus and nystagmus were present. The child apparently could not see. The pupils did not react to light or accommodation. The conjunctivæ were pale; scleræ clear; nasal passages clear; no discharge. The tongue was covered with a heavy white coat; gums swollen; 8 teeth; buccal mucous membranes normal; tonsils small, not inflamed; ears normal. Examination of the chest showed a marked rosary and Harrison's groove. The heart and lungs were apparently normal. The abdomen was large and distended; spleen not palpable; liver extended one finger's breadth below the costal margin. No masses were palpable. The genitals were normal. Examination of the extremities showed enlarged epiphyses. The arms were spastic, the fingers taking the so-called driving position, the palms turned outward and upward; the legs were also spastic, the feet being extended and taking the position of talipes equinus. Mechanical irritation increased the intensity of the spasticity. Chvostek's sign could be elicited by the faintest tapping of the cheek. Trousseau's, Kernig's and Oppenheim's signs were present.

The urine examination was negative. The blood examination showed a normal white count. The R.B.C. was 3,800,000; hæmoglobin, 70 per cent. There was slight secondary anæmia. The blood calcium was 6 mg. per 100 c.c. of blood, which is considered slightly lower than normal. The blood Wassermann was negative. The spinal fluid was negative as was also the spinal-fluid Wassermann. Electrical reactions: With the anodal opening, contractions were obtained with a current of ½ milliampere.

The eye grounds showed the cherry-red spot and optic atrophy.

Summary of Findings.—The history of retardation in development, marked mental and physical retrogression from the age of one year; pronounced loss in weight; prominent frontal and parietal bosses; rosary and enlarged epiphyses; carpo-pedal spasm, spasticity,

Chvostek's, Trousseau's, Kernig's and Oppenheim's signs, positive electrical reactions, and the cherry-red spot.

Diagnosis.—Amaurotic family idiocy, rickets and chronic tetany.

The question arose as to whether the tetany was a part of the amaurotic family idiocy or whether it was a separate condition. The points in favor of the tetany being a separate condition are: (1) The association with rickets; (2) slightly lowered blood calcium content. The point in favor of its being part of the amaurotic family idiocy is the increase in the severity of the carpo-pedal spasm in spite of treatment for rickets and tetany. The child was given 10 grains of calcium chloride every four hours for months and also cod-liver oil, with absolutely no effect on the tetany. The final diagnosis was chronic tetany due to amaurotic family idiocy in a rachitic child.

Subsequent Course.—About a week ago the child began to cough, had a rise in temperature to 101° F., and was admitted to the Post-graduate Hospital wards with a diagnosis of hypostatic pneumonia (right base). Examination of the chest showed numerous râles in the right base posteriorly. Otherwise the condition had not changed from that at the time the child was first seen, there being very marked spasticity and marked carpo-pedal spasm. The present weight of the child is 14 pounds 2 ounces. The general condition of the child is very poor. It is unnecessary to say that the prognosis in amaurotic family idiocy is bad, death occurring usually before the end of the second year; few cases have been reported which have lived as long as this patient.

A CASE OF PERSISTENT JAUNDICE WITH UNKNOWN ETIOLOGY*

By MOSES HENRY EDELMAN, M.D.

Assistant Attending at Post-Graduate Hospital, Babies' Ward; Adjunct Pædiatrician at the Sydenham Hospital; Assistant Instructor in Pædiatrics at the Post-Graduate Hospital and Medical School, New York City

The patient was brought to the Children's Out-patient Department of the Post-graduate Hospital on April 4, 1922, after having visited a number of clinics without apparent relief. The family history was negative for syphilis, tuberculosis, malignancy and jaundice.

The patient was six years old and was the third of four children, two of whom had died: One from diphtheria at four years of age and one in infancy, the cause being unknown. The mother is quite certain that none of the other children were ever jaundiced. The patient was born in normal labor at full term. He was breast fed until eight months old, and received the breast and bottle until thirteen months, and since that time has eaten ordinary foods. He has never taken any form of alcohol, and prior to the onset of the present illness has been healthy, well nourished and well developed.

The present illness began three months ago with drowsiness, malaise, vomiting, colicky epigastric pain, not of the radiating type, a slight itching of the skin and a temperature of 101° F. by mouth. He had had no chills, headache, or diarrhœa. Twelve hours after the onset, the skin and sclera assumed a bright lemon-yellow color. The general symptoms subsided in forty-eight hours, but the jaundice has remained to the present time, varying in intensity, but never absent. The stools were rather constipated, the color varying from light brown to clay color. The urine was intensely dark at the onset, staining the clothing; it has since become somewhat paler but is still bile colored. The patient has had one nose bleed during the entire illness.

Physical examination on April 4, revealed a moderately well-nourished, a well-developed and mentally normal male child of about

* Patient shown before the Section on Pædiatrics, New York Academy of Medicine, May 11, 1922.

6 years of age; weight, 47 pounds, 4 ounces; height, 45½ inches. The entire skin surface, conjunctivæ and scleræ were markedly jaundiced. The mucous membranes were rather pale and showed no evidence of hemorrhages. The tongue was slightly coated; the teeth in fair condition. The pharynx revealed imbedded tonsils showing evidences of old inflammatory processes. The heart and lungs were negative. Examination of the abdomen showed the edge of the liver smooth and easily palpable, being about two inches below the costal margin in the nipple line. There was no tenderness, distention or ascites. The spleen was not palpable. The rectal temperature was 99.6° F.; pulse, 108; respiration, 28. In all other respects the physical examination was normal.

The laboratory findings were as follows: Urine: specific gravity, 1015; dark brown in color; of acid reaction; bile, strongly positive; few leucocytes; negative for spirochetes. Stool: light brown in color; no hydrobilirubin, ova, parasites or spirochetes were found. Blood: R.B.C., 3,155,000; hæmoglobin, 55 per cent.; W.B.C., 8850; polymorphonuclears, 41 per cent.; lymphocytes, 59 per cent.; negative for plasmodia. The red blood-cells showed beginning hemolysis at 0.4 and complete hemolysis at 0.3. The blood Wassermann was negative; the von Pirquet was negative. X-ray findings: The only pathological findings worthy of note were pylorospasm, delayed motility through the small intestines, and a *twenty-four hour colonic hypermotility.* This may be *reflex due to obstructive jaundice.*

Treatment.—On April 4, the patient was given two grains of calomel in divided doses, and sodium phosphate, 2 teaspoonfuls every morning. A diet poor in fat was ordered, but there was no apparent improvement. On April 19, following the X-ray report of pylorospasm, atropine-sulphate treatment was instituted, and since then the mother thinks the child eats and feels better, but the jaundice is still about the same.

To summarize the important findings in this case we have the following: Sudden onset preceded by acute dyspeptic disturbances; remission of all symptoms in forty-eight hours except the jaundice, which is somewhat intermittent in type; liver slightly enlarged, but not tender; no splenic enlargement; the presence of bile in the urine; changes in the color of the stools; normal fragility of the

red blood-cells to the action of hypotonic salt solution; negative alcoholic history; negative Wassermann and von Pirquet; no plasmodia found in the blood, and no spirochetes found in the urine, stools or blood. A mild secondary anæmia was present.

In considering the probable causative factors of this persistent jaundice, it is hardly necessary for us to consider the group of cases of jaundice occurring at birth and early infancy as persistent icterus neonatorum, familial congenital icterus hemolyticus and jaundice due to congenital malformation of the bile ducts. In view of our findings we are only justified in considering briefly the following diseases which may be responsible for this symptom complex:

Catarrhal and Infectious Jaundice.—These may be considered together, as they probably represent a closely related group, which at times is epidemic in type, and occasionally assumes a grave form known as Weil's disease. The manner of the onset and the course of the symptoms is quite suggestive, but the persistence of the jaundice for over four months and the absence of spirochetes are probably suggestive of another cause. It is of course possible, but rare, that such cases in children may occasionally be due to biliary calculi (ball and socket type), malignant growths, or the wandering of a worm into the biliary ducts, causing true obstructive jaundice.

Hemolytic Types of Jaundice.—Of these we need only consider the *acquired or Hayem's type.* This type of jaundice may develop at any age, is not preceded by dyspeptic disturbances, may become chronic, is accompanied by anæmia, hard and enlarged spleen, increased fragility of the red blood-cells, and the absence of bile in the urine.

A CASE OF CHRONIC LEAD POISONING WITH ENCEPHALITIS*

By N. R. NORTON, M.D.

Physician to the Babies' Hospital, New York City

This patient, G. B., eight months old, was admitted to the Babies' Hospital on April 2, 1922. She had been breast fed, six nursings daily, to date of admission, and had been out of doors daily. Her birth-weight was 7½ pounds. She gained weight for six months; for the past two months her weight has been practically stationary, and she has been growing paler.

At the time of admission the child weighed 1300 gms. (13 pounds, 9 ounces). She seemed happy and well up to two days before admission, and since then had been constantly whining and fretting. At noon on April 2, the day of admission, she had a convulsion. Her temperature at this time was 98.6°F. The convulsion, while general, was more marked on the right side.

Physical Examination.—A pale, fretful child, without teeth, appearing to be below par; the scleræ frequently visible above the cornæ; the mouth drawn tightly to the left when crying. There were rhythmical movements of the forearms. The head was asymmetrical with parietal and frontal bosses; craniotabes more marked on the right than on the left side. The fontanel was full and somewhat tense. The pupils were widely dilated and their reaction sluggish and slight, with loss of light-reflex. There was a transient spasticity of the legs, hyperactive leg reflexes, and a suggestive Trousseau of the right arm. The electrical reactions were typical of tetany.

Lumbar puncture on April 2 revealed a clear fluid, faintly yellow. Six c.c. were withdrawn. The pressure was apparently normal. The cell count was 12 (95 per cent. leucocytes) for an average of three counts. Globulin was plus and sugar, plus.

On April 5, the child was readmitted to the hospital. She had

* A patient presented before the Section on Pædiatrics, New York Academy of Medicine, May 11, 1922.

not seemed normal after discharge, being quiet and sleeping all day. She also had a convulsion at 9.30 A.M. Since then she had had several convulsions lasting five minutes, at times generalized. More frequently she had had twitchings of the right side of the face. The child became restless, did not sleep, and did not notice objects; she moved her head and eyes continually. The fontanel was a little tense; knee-jerks exaggerated; positive Babinski; no rigidity of the neck or Brudzinski.

At this stage it seemed most likely that the child had an atypical tuberculous meningitis.

Lumbar Puncture.—Twenty c.c. of clear fluid were removed, under pressure+++. The cell count was 30 (polymorphonuclears, 3 and lymphocytes, 27). Globulin was ++. No tubercle bacilli were found.

Blood.—Hæmoglobin, 72 per cent.; R.B.C., 4,000,000; W.B.C., 18,350; polymorphonuclears, 54; lymphocytes, small, 43, large, 3; nucleated red cells, 11 per 100. The W.B.C. and the cytoplasm in nearly all specimens took the polychrome stain. The R.B.C. stained poorly. The marked feature was the quantity of Grawitz basophilic granules in the red cells.

Because of this blood picture lead poisoning with encephalitis seemed the most likely diagnosis. There was no history of plumbism in the family. The child's toys were celluloid. The drinking water came through galvanized iron pipes. The child had never chewed at the enamel on its bed. Neither mother nor father showed any lead line on the gums. Smears of blood from each parent were normal. The father was a farmer. Both the von Pirquet and the intradermal tests were negative.

April 8: At this time the following facts were elicited. From February 9 to April 3, the mother had used for an eczema of the right breast, except when the baby was actually nursing, an ointment, "Diachylon Compound." The label stated that its chief ingredient was lead acetate, other constituents being boric acid and ichthyol. The exact formula was not given.

April 10: Blood examination showed that the characteristics of the smear persisted.

April 12: Lumbar puncture was performed, 12 c.c. of clear fluid being removed, under slightly increased pressure. The cells numbered 15 (polymorphonuclears, 2; lymphocytes, 13). Globulin, +++; sugar, +; film examination negative.

For the first three days the child had about two convulsions daily, none since.

April 15: There was stippling in but few cells. The anæmia was increased; hæmoglobin was 53 per cent.

April 20: The child was transfused, 120 c.c. blood being given by the direct method, the mother being the donor.

April 28: A composite specimen of urine collected April 10-13 was negative for lead.

May 1: Examination of the spinal fluid showed 5 lymphocytes; globulin, ++; sugar, +; film negative.

The blood at this time showed R.B.C., 5,540,000; hæmoglobin 79 per cent. There were no nucleated red cells in counting 100, but one or two cells showed basophilic stippling.

May 9: The blood Wassermann was negative.

Summary.—We have then a child with convulsions, anæmia, marked basophilic stippling of the red cells, a spinal fluid characteristic of an encephalitis, and a direct history of a source of lead ingestion, though lead was not found in the urine. It may be noted that lead is more commonly found in the feces than in the urine.

Blackfan in the *Amer. Jour. of Med. Sci.* for June, 1917, reviews the literature and cites four similar cases in Doctor Howland's service at Johns Hopkins Hospital. He also quotes a large number of cases which occurred in Australia.

METASTATIC ABSCESS OF THE LIVER*

WITH SPECIAL REFERENCE TO ITS OCCURRENCE IN CHILDHOOD

By JAMES A. CAHILL, Jr., M.D., F.A.C.S.

Surgeon to the Providence Hospital, Washington, D.C.

After a review of the literature on abscess of the liver, one is impressed with two facts bearing upon its etiology; that is, it is both a tropical and a non-tropical disease. By far the most common type in the South and Tropics is that which occurs with, or as a sequel to, amœbic dysentery, and the type of hepatic suppuration which we occasionally see in temperate climates is that of an embolic origin. Abscess of the liver is a suppurative degeneration of the liver radicals. It may be produced by bacterial invasion, especially staphylococcic and streptococcic, or it is sometimes seen as a sequel to amœbic dysentery. These organisms reach the liver by the general circulation, or more frequently by being taken up from the intestinal tract, reaching the liver by the portal circulation, or by the lymphatics. Appendicitis with lymphatic infection may result in hepatic abscess. Liver abscesses may directly result from peritoneal infection. The fact that abscess of the liver is in hot countries frequently preceded by amœbic dysentery led to the presumption that the amœba coli produced the abscess, and in a large majority of cases of tropical abscess amœba exist in the pus, or at least on the abscess walls.

The subject is one of such a broad scope that the writer will therefore confine himself to the metastatic type, and present a brief resumé of the clinical data on embolic hepatic suppuration only. Hepatic abscess may follow traumatism, dysentery, cholangitis, suppuration of a hydatid cyst, gall-stones, typhoid fever, appendicitis or any peritoneal infection. Abscess of the liver, when metastatic, is usually multiple. They may be caused by foreign bodies and parasites. When hepatic abscesses are of a pyogenic origin, we see two distinct types: First, that which is called a liver pyemia or a septic pylephlebitis of the branches of the portal vein, secondary to emboli coming from the mesenteric veins, due most often to gangrenous appendicitis. The

* Read before the Medical Society of the District of Columbia, Washington, March 29, 1922.

liver is usually large but not greatly. The abscesses are multiple and consist of rather narrow suppurating and necrotic tracts frequenting the branches of the portal vein. Efforts to evacuate their contents are usually useless owing to their multiplicity, and a fatal result is usually the terminus.

The other type of pyemic and metastatic abscesses are those arising from infective processes of the alimentary tract and its associated glandular organs. This type is also seen following injury or severe traumatism to the liver, from ulceration due to foreign bodies or from a general systemic pyemia. These abscesses are solitary and demand operation as soon as they can be localized.

The metastasis occurring in the pyemic type takes place by either the lymphatics or the blood-stream, and after consideration of the portal system of veins one is easily impressed with how an infected embolus might detach itself and travel through the intricate venous channels to finally lodge in the liver parenchyma. The portal system of veins are the veins which drain the blood from the abdominal part of the alimentary canal with the exception of the lower part of the rectum, and drain from the spleen, pancreas and gall-bladder. From these viscera the blood is conveyed to the liver by the portal veins. In the substance of the liver, the portal vein ramifies like an artery and terminates in the portal capillaries from which the blood is conveyed to the inferior vena cava by the hepatic veins. From this it will be seen that the blood of the portal system passes through two sets of capillary vessels, that is, first the capillaries of the alimentary canal, spleen, pancreas and gall-bladder, and second the portal capillaries in the substance of the liver itself. The tributaries of the portal veins are: The splenic, superior mesenteric, gastric, pyloric, and cystic. The superior mesenteric vein returns the blood from the small intestine and from the cæcum and ascending and transverse portions of the colon. It begins in the right iliac fossa by the course of the veins which drain the terminal of the ilium, and cæcum and vermiform appendix, and ascends between the two layers of the mesentery on the right side of the superior mesenteric artery. In its course upward, it passes in front of the right ureter and inferior vena cava and the head of the pancreas, behind which it unites with the splenic vein to form the portal.

The lymphatics accompany the principal blood-vessels, and lead toward the liver in two groups: Those of the convex surface, and those of the inferior surface. The lymphatics accompany the principal blood-vessels, and a very complete description of these channels of infection is given by Percy Herring and Sutherland Simpson[1] from the Physiological Laboratory of the University of Edinburgh. The lymphatics of the liver were described by Mascagni, Cruickshank and other anatomists, who emphasized the method of rendering them visible by the injection of quicksilver. As a result of their work, we have the classification of the lymphatics of the liver into a superficial and deep set. A superficial set forming a network on the convex surface of the liver unites in a trunk which passes along the suspensory ligament through the diaphragm to join the thoracic duct. On the concave surface the vessels unite near the gall-bladder, some pass to the convex surface, some to the portal vein, while others sink into the substance of the liver. The deep set of vessels accompany the branches of the portal vein, hepatic artery and bile ducts, but do not penetrate into the lobules. They run to lymphatic glands along the portal vein. The lymphatics of the liver appear to be limited to the connective tissue, and have a distribution similar to that of the hepatic artery. The liver furnishes an exception to the general rule that the cells of a secreting gland receive their nutritive supply indirectly from the blood by means of lymphatics. The liver cells receive their nourishment directly from the blood by fine channels which communicate with the interior of the blood-vessels. Therefore, the lymphatics are separate and distinct of the blood-vessels but surround them. Thus we see bacteria may gain entrance from an original focus of infection in some remote parts of the peritoneal cavity, and be quickly carried to the liver by either of the above great channels; therefore hepatic abscesses are in a large majority of cases either lymphogenous or hematogenous infections.

VARIETIES

Abscesses of the liver are divided into the tropical abscess, which variety we are not dealing with; those of traumatic origin; and those of infection or of the pyemic type. Hepatic suppuration due to traumatism is an occasional cause, the injury is generally of hepatic

origin, and instances have been recorded of abscesses of the liver occurring in trainmen, who were injured while coupling cars.

The metastatic or embolic abscess is the most common type which we see in this climate. It occurs either in a general pyemia or as a subsequent infection to some remote foci in the territory of the portal vessels. Although the literature tells us that this type of hepatic suppuration is the most common in this climate, comparatively few cases are seen, and especially in view of the fact that the many cases given in this disease are an everyday operative occurrence.

SYMPTOMS AND SIGNS OF HEPATIC ABSCESS

The symptoms of all types of hepatic suppuration are somewhat similar, and may be very definite and positive, although in the metastatic or pyemic type they may be frequently perplexing and obscure, and in some cases nothing whatever directs the surgeon's attention to the liver until the patient coughs up an enormous amount of the characteristic material, rupture having taken place in the pleura.

The symptoms may be summed up into four heads: Fever, sepsis, enlargement of the liver and pain. In about three-fourths of the patients, fever and sweats are commonly present, and in the remaining one-fourth there is usually an evening rise preceded by a chilly sensation or by a chill. As the temperature begins to fall toward morning, there is a profound sweat, or maybe nausea and vomiting. The patient's appetite fails; skin becomes pasty and clammy. The entire liver is usully enlarged and the enlargement may be detected by percussion, and in many cases a hard smooth area can be palpated. As an abscess becomes adherent to the surface, there may be a skin œdema and dusky discoloration. The liver is tender especially at the lower margin of the organ. There is usally pain which is dull and heavy, and as the abscess nears the surface of the organ, the pain becomes sharp and lancinating. The pain is persistent, but is not localized, leading to the back and to the shoulder. The leucocyte count is of no particular help in the diagnosis, as there may be or may not be a leucocytosis. It is usually, however, marked in the pyemic type. Urine is usually scanty. In pyemic abscesses there may be slight jaundice, and the general symptoms of a pyemia exists. The abscess may be perforated

externally from adhering to the surface and rupture through the skin or it may perforate into the stomach or bowels, or into the pleura.

Prognosis.—The prognosis of hepatic abscess is rather guarded. It has a high mortality, although the death rate has been lowered in recent years owing to the increased operability of the patient, and the increased knowledge and study of these hepatic conditions.

Diagnosis.—Abscess of the liver of the tropical type may be confused with the malarial infections or an intermittent fever of some unknown origin especially existing with gall-bladder disease. In the metastatic or pyemic type, any septic temperature coincident with severe pain in the right hypochondrium associated with an enlarged liver, following an abdominal infection should draw our attention to the possibility of hepatic abscess.

Treatment.—The treatment may be considered under two heads: Prophylactic and the operative. Some authorities place the tropical abscess in the list of preventable diseases and every care should therefore be taken by the new arrival in a tropical country to constantly guard against exposure to amœbic dysentery. Unfortunate to say, there is no prophylaxis or measures that we can pursue to prevent the pyemic type, or that occurring as a result of infected emboli such as follows acute gangrenous appendicitis; but this may be another reason to operate an appendix earlier.

The operative treatment in all types of hepatic abscesses, after a definite diagnosis and localization is made, aims toward complete evacuation. The drainage of an hepatic abscess should be through an incision which gives promise of ready access to the abscess, and is so performed as to diminish the danger of contaminating other structures. The choice of incision will vary in different cases. Operation may be abdominal or trans-pleural or a combination of these routes.

Operation by the Abdominal Route.—This method is indicated especially in the cases where the border of the right lobe of the liver is displaced downward, and well below the costal margin. When local tenderness and rigidity is present, œdema renders it probable that the liver is adherent to the parietal peritoneum. A vertical cut is made exposing the liver at the chosen point. If the liver is adherent over a considerable area, the abscess may be sought for, or the peritoneum

may be protected by a gauze packing or pads, and the abscess sought for or the parietal peritoneum may be sutured to the liver, and the liver explored; or third, packing may be introduced and the opening of the abscess delayed for two or three days until adhesions are formed.

If one is to use the aspirating needle, it should be used when everything is in readiness for following the needle instantly with a knife. By following this caution two risks may be avoided; unnecessary contamination of pleura or peritoneum, and failure again to find the abscess after the needle has been withdrawn. If the operation is done in a hospital equipped with a suction apparatus, this can be connected with the trocar and thrust into the abscess and evacuated in this manner. After withdrawing the trocar, a large soft rubber tube guarded by a safety pin at its outer portion is introduced into the abscess cavity.

Operation by a route through the abdominal wall and pleura is made to approach the abscess through the diaphragm without opening the pleura. A vertical incision is made opening the peritoneum facing just below the ribs. It is extended upward, and several ribs are excised and the pleura pushed away. If the pleura cannot be readily pushed away, it is incised and both layers are sutured to the edge of the wound in the diaphragm.

John W. Keefe,[2] in an article published in 1919 on abscess of the liver, strongly condemns the use of the aspirating needle, and trocar and canula, and says they are dangerous instruments to use in the abdominal cavity regardless of how useful they may be in other parts of the body. He states that not many years ago, the aspirating needle was used to determine the presence of pus in the pelvis, while now the incision is carefully made through the vault of the vagina into Douglas's pouch. Some years ago, the aspirating needle was used to determine the presence of an appendiceal abscess. No one would think of operating upon an appendiceal abscess to-day in this way. If one has a definite knowledge of the anatomy involved, he should not hesitate to operate with an incision large enough to give ample inspection of the parts as the operation progresses. After the capsule of the liver has been incised a blunt-pointed artery clamp may be pushed into the liver at the site of the abscess. The blunt instrument will push aside instead of injuring the arteries or veins in the liver. Dr. George F.

Johnson[3] says surgical treatment of abscesses of the liver must be prompt, bold and radical. No measure will succeed which does not completely evacuate the abscess cavity and allow free drainage.

My object in reporting this case is to first present a subject of considerable interest, and to call attention to the fact that this hepatic abscess occurred in a child of four years. That it was one of the pyemic type, and rather interesting in the result obtained following operation on these metastatic abscesses.

This abscess was a single one undoubtedly and not of the pylephlebitis type as otherwise our efforts would have proved useless.

The literature shows several abscesses reported in children. A case of liver abscess in an infant due to a streptococcus infection spreading from the umbilicus to the liver is reported by C. V. Turner,[4] and in *British Med. Journal* in 1915, the pathology originating from a cord infection. The child was a male and five weeks old. H. D. Rolleston[5] in 1913 described a case of a baby seven and one-half months in which a single abscess the size of a pigeon's egg was found post-mortem in the right lobe of the liver, together with a bronchopneumonia at the base of the right lung. The infection was streptococcal.

Niblock[6] records a case in India of a baby eleven months with a history of diarrhœa in which the pus from the liver was typical of a tropical abscess.

Acuna[7] found a single liver abscess in the right lobe of the liver in a child two and one-half years following an attack of gastroenteritis.

James R. Judd,[8] of Honolulu, reports a case of liver abscess in an eight-year-old boy with operation and recovery.

Mathews[9] reported a case of liver abscess in a child and emphasized the fact that it was quite uncommon in the tropics and was exceedingly rare in this climate.

Scott[10] reports a case of hepatic suppuration in a young infant, particularly emphasizing the type of a pneumococcus origin and having its metastasis from the lungs through the general circulation.

Gerlach,[11] of Germany, records one of the latest in a young child of solitary abscess with recovery.

The literature on hepatic suppuration in children shows it to be an uncommon pathology. Holt[12] in his book on "Diseases of Infancy

and Childhood," in 1919, states that only a very few cases are recorded, and credits Musser with a review of the literature up to 1890. Up to that time only 34 cases had been reported. Since then he says additional cases have been added.

In my review of the literature I had access to a classification at the Surgeon General's Library. The series index is in three groups. There are 34 cases as collected by Musser [13] up to 1890. The first recorded case of hepatic suppuration in children was reported by Brown [14] in 1821 before the Medical and Chirurgical Society of Edinburgh.

The second series is a group of 17 cases including those reported up to 1904. Since 1904 and up to the present date 21 additional cases of liver abscess in children under thirteen years have been reported.

These cases of hepatic abscess in infancy and childhood comprise all varieties and include those of every known etiology and total about 72 cases. The various etiological factors being those arising from suppuration of echinococcus cysts, tropical abscess from the amœba histilitica, those of embolic origin seen following intra-peritoneal infection and those of embolic origin with metastasis from the general circulation, such as pneumococcus abscess as a sequel to lobar pneumonia and a hepatic abscess as a complication to measles. About 60 per cent. of these cases are of embolic origin and the mortality was about 50 per cent.

Keen [15] states that single hepatic abscesses run a rather long and protracted course, whereas the multiple abscess formation is very acute and the symptoms are marked by first pyemia, and second hepatic enlargement; also another diagnostic point is that the spleen is enlarged in the multiple type or pylephlebitis form, whereas in the single metastatic abscess it is not.

REPORT OF A RATHER UNUSUAL CASE OF ABSCESS OF THE LIVER OF THE METASTATIC TYPE: OPERATION—RECOVERY

B. H., aged four years, male, white, was referred to me on September 16, 1921, complaining of pain in right upper and lower quadrants.

Family History.—Father and mother both living and well; one brother living and well; two sisters living and well; had measles and chicken pox in childhood, made good recovery. When two years of age had convulsions, which his mother attributed to teething, but his family physician thought it due to some form of intestinal toxæmia. The digestion and general health of the child have been usually good. On July 13, 1921, while on a visit in Middletown, Ohio, he was

seized with severe pain in the abdomen especially about the umbilicus and right lower quadrant. He had severe nausea and vomiting. His mother called a physician, who attributed his illness to dietetic error, or a possible gastroenteritis. On July 15, he still complained of pain and tenderness in the abdomen, but seemed better and his physician did not return to see him until six days later on July 21, when he held a consultation with a surgeon, who advised immediate operation, as a distinct mass was then palpable in the right iliac fossa.

I have communicated with his surgeon, and he sent me a complete and detailed physical examination and operative findings in this case. He was operated upon on July 21, 1921, eight days after the onset, and a large appendiceal abscess was drained. On account of the patient's condition, no attempt was made to remove the appendix. After the operation, the patient had a rather stormy convalescence and the wound drained and he ran an irregular temperature for some time. He returned to this city the early part of September, 1921, and the wound had just healed; his temperature was then normal. After staying at home for two weeks, complaining more or less of pain in the right upper and lower quadrants, he began to have an evening rise of temperature, with definite chill and profuse sweats. I was called in consultation on September 16, 1921, and upon examination at this time, the little fellow presented a fairly well-nourished appearance. His abdomen showed a small healed McBurney's scar; the liver was somewhat enlarged and tender, and definite tenderness and rigidity over the appendix in the right lower quadrant. Left side of the abdomen was negative. I advised operation, believing that he had a focus of infection in the old appendix which was affected in July, and was still giving him his sepsis. He entered Providence Hospital on September 17, 1921, with a temperature of 102° F., leucocyte count of 15,000; urine was negative. A radiograph showed an enlargement of the liver, but other findings were negative. At operation a right rectus incision was made, and the appendix was found in a mass of old, indurated tissue and adhesions. It was very large, thick, kinked and adherent; there was no free pus; the appendix was removed in the usual manner; liver was large, and when explored, the structures about it seemed congested, but otherwise no evidence of pathology presented itself at this time, and the abdominal wound was closed. The patient's temperature following operation came to normal within three days, and remained so for two weeks, and then he had a slight elevation which soon subsided, and he was discharged on October 8, 1921, in fairly good condition.

After going home, his temperature rose and he ran a septic fever for a period of ten days, with chill and profuse sweats; the little boy complained severely of his upper right quadrant, and on October 27, 1921, a small, indurated, red and œdematous area appeared in the right hypochondrium, just at the costal border and over the right lobe. A diagnosis of abscess of the liver was made, and the child was again sent back to Providence Hospital and was admitted for the second time on October 28, 1921. Operation was done immediately, when an incision was made through the fluctuating area, and a finger inserted into the abscess cavity and nearly a pint of thick, chocolate-colored pus streaked with blood was evacuated. A rubber drainage tube was inserted and patient was sent back to his room. His temperature came to normal within four days and

remained so, and he was allowed to leave the hospital on November 7, 1921, about ten days after his operation, to convalesce at home.

It is interesting to note that the pus from the hepatic abscess showed a *Streptococcus hemolyticus* and also a culture from the pus taken from the appendix of the second operation showed the same organism. The abscess drained at home for a period of about seven weeks, and finally subsided, the patient's appetite returned and is at the present time completely well. He runs about and plays with the rest of the children, and is gaining in weight and appears to be none the worse for his experience.

In conclusion I wish to say that several other conditions were considered in the case of mine reported above as a possibility, namely sub-diaphragmatic abscess, multiple embolic abscesses of the liver, local abscess, from the rupture of a suppurating gall-bladder, etc.

However, nature diagnosed this condition for us and the diagnosis was self-evident after having felt a very large liver at operation five weeks before and knowing at exploration at that time that no abscess existed outside the liver or between the diaphragm and liver, that there were no chest symptoms, and that there was definite perihepatis. The place of localization and position of pointing was significant and it was well over in the right upper quadrant and in the line of the ordinary high right rectus incision. The chocolate-colored pus with fine pieces of necrotic hepatic tissue was characteristic.

REFERENCES

[1] Herring, Percy T., and Sutherland Simpson: *British Med. Jour.*, London, 1906, ii, 1797.

[2] Keefe, John W.: *Tr. Am. Asso. of Obs. and Gyn.*, Vol. xxxii, 1919, 325.

[3] Johnson, George F.: Quotation, Dr. J. W. Keefe, *Tr. Am. Asso. of Obs. and Gyn.*

[4] Turner, C. V.: *British Journal Children's Diseases*, London, 1915, xii, 107-109.

[5] Rolleston, H. D.: *British Medical Journal*, 1913, ii, p. 847.

[6] Niblock, W. J.: *Indian Medical Gazette*, 1911, xlvi, p. 137.

[7] Acuna, M.: *Arch. Latino Am. de Pediat.*, 1912, V. P. 213.

[8] Judd, J. R.: *Arch. Pediat. N. Y.*, 1910, xxvii, 451.

[9] Mathews, Frank S.: *Annals Surgery*, Phila., 1911, liii, 424.

[10] Scott, A. J.: *Calif. State J. M.*, San Fran., 1918, xvi, 337.

[11] Gerlach: *Kor. Bl. allg. Artz. Ver.*, Thur., 1921.

[12] Holt: *Diseases of Infancy and Childhood*, 1919.

[13] Musser: Holt, *Diseases of Infancy and Childhood*, 1919.

[14] Brown, J.: *Tr. Med., Chir. Society*, Edinburgh, 1821.

[15] Keen: *Keen's Surgery*, vol. iii.

ANGIOMA*

By STAFFORD McLEAN, M.D.

Assistant Attending and Chief of Clinic at the Babies' Hospital; Attending Pædiatrician to the New York Orthopædic Hospital, New York City

The three common types of angioma are: (1) Capillary nævi (flat vascular nævi), or portwine stain, occurring chiefly in the frontal region and about the occipital and suboccipital regions; (2) plexiform angioma, which are generally small and circumscribed, but project above the skin; and (3) the cavernous angioma which may be found anywhere in the body and which are the most common of all.

Portwine stains may become more intense as age advances, or they may be cured spontaneously. I have had no opportunity to follow up any cases which have been treated, but I know that Doctor Fordyce has removed a great many with carbon-dioxide snow. Our experience has been almost entirely with cavernous angioma, as with the others the parents are usually content to let well enough alone. The fact that the cavernous type in some instances has a tendency to increase in size, and in others because of their location are such a definite handicap to the individual that it is generally good advice to urge their removal. The question of particular interest to us is whether the angioma should be removed surgically, by the galvanocautery, by the X-rays, by carbon-dioxide snow, or by radium.

Our procedure at the Babies' Hospital Dispensary is to have the patient examined by our attending surgeons, Doctor Downes or Doctor Bolling, to determine whether the angioma can be successfully removed surgically. If not considered surgical it is referred to Doctor Fordyce. If he or his associates do not consider it a case for carbon-dioxide snow it is referred to Doctor Rulison at the Presbyterian Hospital, who conducts the radium therapy. Judging from my limited experience in following these cases there are fairly definite indications for certain types of therapy.

For the cavernous angioma of moderate size with a hard background like the bones of the skull or any other bony background or

* Eight patients shown before the Section on Pædiatrics, New York Academy of Medicine, May 11, 1922.

even firm muscle that yields counter pressure, carbon-dioxide snow is probably the method of choice. The treatment is of short duration, one-half to one hour. The age for treatment is six months to one year. An angioma of the same size, let us say not larger than a silver dollar, which is situated in a region without a hard background but is readily accessible surgically may be excised.

In larger angiomata where there is no firm background radium therapy would seem to be indicated. Where radium therapy has to be continued for any length of time, the possibility of developing telangiectasia and an atrophic skin followed later by keratosis and epithelioma has to be considered. Most of the radium applications given by Doctor Rulison in our cases, were one-half to one hour applications of 75 milligrams of radium. The tubes are imbedded in a square of wax at about ½ cm. distance from the face, supported by adhesive plaster. The applications are made a few weeks apart, and it generally takes three to six treatments before the tumor disappears. There is apparently no pain.

The galvano-cautery is used less with infants than formerly; none of our patients were so treated. It is very painful and for this reason it is difficult to control the child sufficiently to permit of successful therapy.

None of our patients has been treated with the X-ray. The advantage of carbon dioxide over radium is in the fact that one application—rarely two are necessary—causes a disappearance of the tumor. There is a marked reaction, however, and the child generally has considerable pain for the following twenty-four to forty-eight hours. Radium treatment is more tedious, but there is no reaction in the cases I have seen. It takes considerably more skill and experience to use carbon-dioxide snow successfully than radium. One of my cases in private practice had a very pronounced cavernous angioma which involved the lower lip, the floor of the mouth, and part of the tongue, which was most successfully removed by Doctor Fordyce with carbon-dioxide snow.

I am presenting this evening eight cases of cavernous angioma which are under treatment with radium, some of these which have received a number of treatments show almost complete obliteration of the angioma.

Clinical Surgery

STONE IN THE KIDNEY *

By DANIEL N. EISENDRATH, M.D.

Clinical Professor of Surgery, Rush Medical College; Attending Surgeon, Cook County and Michael Reese Hospitals, Chicago

The patient whom I will show you to-day is a man of thirty-six years of age who was operated upon, for the first time, six weeks ago, calculi being removed from his right kidney, and was reoperated upon two weeks ago, when there was removed a large branching calculus of the left kidney.

Upon admission to the hospital he gave a history of having suffered from pain in the right lumbar region, and loss of weight for about six months. The pain was brought on by bending over during his work, or whenever he was not able to urinate. It is relieved by micturition, by lying on his back or by having a movement of the bowels, but only to a slight degree. The pain was stabbing in character, radiating from the right lumbar region toward the front of the abdomen and occasionally to the left side.

His past history was negative except for an attack of gonorrhœa about two years ago. The physical examination was negative, with the exception of extreme tenderness over the right costovertebral angle. Neither kidney could be palpated by bimanual examination. The reflexes were normal; blood-pressure, 135 mm.; examination of the prostate, seminal vesicles, epididymi and testes was negative. The urine was alkaline with much albumin, blood and pus cells. The results of cystoscopy and ureteral catheterization were as follows: The bladder was normal; no obstruction was met with by the ureteral catheter on either side. Urine from the right kidney contained a great many pus cells, and from the left it was quite clear. The bladder and ureteral orifice appeared normal. Phthalein injected intravenously appeared in the urine in fifteen minutes, very dilute

* A clinical lecture delivered at the Cook County Hospital.

from the right kidney, and in four minutes, with good concentration, from the left kidney.

The X-ray showed a triangular shadow (Fig. 1) located opposite the transverse process of the first lumbar vertebra on the right side, which was interpreted as indicating that the calculus was located at the ureteropelvic junction, as I will explain later. In the same kidney, at its lower pole, were seen two irregular shadows considerably smaller than the one lying on the renal pelvis. On the left side (Fig. 2) there was a coral-like shadow, evidently a branching calculus, occupying the entire pelvis, and the major and minor calyces of the upper and lower poles respectively.

The question arose whether the patient should be operated upon at all, and if operated, from which side one should remove the calculi. Several factors influenced my decision to operate rather than to pursue expectant treatment. One of these factors was the danger of complete blocking of the outlet of the right renal pelvis by the triangular calculus located there. This would throw the entire work of excretion upon the left kidney whose pelvis was already occupied by a large branching calculus. Another factor that influenced my decision to operate was the subjective symptom of severe pain which meant an intermittent blocking of the outlet of the renal pelvis by this right-sided calculus, with retention of urine behind it, and increased intrarenal pressure. The reason why I mention that the question of expectant non-operative treatment was considered is that there is a tendency at present toward non-intervention in cases of bilateral calculi. As I will explain later under the heading of treatment, there is danger of recurrence of renal calculi which takes place in about 15 to 20 per cent. of all operative cases. It is self-evident that this relatively large per cent. is not all due to true recurrence, and that in many of the cases the calculi which we find after an operation were not reformed, but in reality overlooked. Barney,[1] of the Massachusetts General Hospital, has recently quoted some interesting statistics in this respect, and showed that in many cases there were shadows of calculi which had been overlooked in the X-ray plate and found within a few months after the original operation.

The first operation was performed six weeks ago, and consisted in

[1] *Boston Medical and Surgical Journal*, January 5, 1922, vol. 26.

removing calculi from the right kidney. The incision which I made is the usual one (Fig. 3); it begins along the outer border of the erector spinæ muscle, just above the costovertebral angle, divides the fascia covering the erector spinæ muscle, and then curves inward and downward midway between the last rib and crest of the ilium until it reaches a point about two and a half to three centimetres above the anterior superior spine of the ilium. I will describe my technic further in connection with the subject of the operative treatment of calculi.

The kidney in this case was found slightly larger than normal. There were many dense adhesions around the lower pole, and careful search was made for polar vessels, an important step which I shall also describe later. The kidney was then brought out through the incision, separating all adhesions. The pelvis was covered by a layer of fat about one inch in thickness, which showed considerable inflammatory change, thus making access to the posterior aspect of the pelvis quite difficult. Through the parenchyma of the lower pole one could then feel several calculi which corresponded to the shadows (Fig. 1) seen in the X-ray at this location.

Pyelotomy is in my opinion the operation of choice for the removal of calculi in the kidney, and should be supplemented as it was in this case, with small incisions through the cortex—nephrotomy. If a pyelotomy incision does not permit of sufficient access to the renal pelvis, a so-called enlarged pyelotomy can be done which I will describe later under the head of operating technic. Lying within the pelvis of this kidney, close to its outlet, was a triangular calculus of the size of one and a half by three centimetres, which was removed through the usual pyelotomy incision. The mucous membrane of the renal pelvis was intensely red and swollen, showing there had evidently been retention with complicating infection from time to time. The pelvis was considerably enlarged, so that the little finger could be easily introduced through the pyelotomy incision, and thus the interior of the calyces—at least the primary—easily palpated. This examination disclosed the fact that the two calculi lying at the lower pole were not in any of the major calyces (Fig. 4), but lying in dilated secondary calyces and could be more easily removed through a small nephrotomy incision than to try to force them into the pelvis and

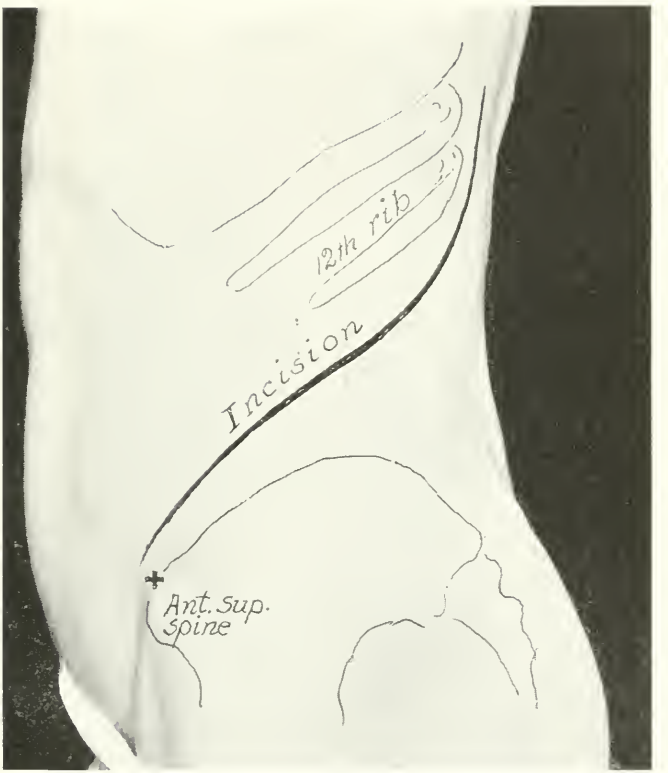
Fig. 1.

[Shadows of calculi in *right* kidney of case reported in clinical lecture of Doctor Eisendrath.

Fig. 2.

Shadow of *left*-sided branching calculus in same patient as Fig. 1

Fig. 3.

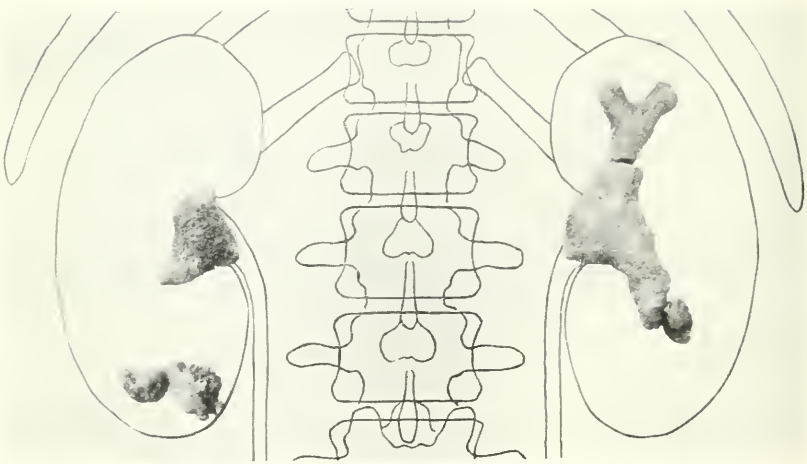


Line of incision usually employed in kidney operations, extending from the angle of the junction of the last rib and kidney border of the erector spinæ muscle obliquely downwards and inwards to a point one to one-and-a-half inches above the anterior superior spinæ of the ilium.

Fig. 4.

Pyelogram of normal kidney showing major and minor calyces.

Fig. 5.



Location and size of bilateral calculi in case presented in Doctor Eisendrath's paper.

deliver them through the original pyelotomy wound. The opening in the pelvis was closed with interrupted sutures of very fine 000 chromic catgut. At the upper end of the pyelotomy incision, close to the parenchyma of the kidney, the wall of the pelvis was so fragile that sutures cut through. We did not fear any escape of urine, in spite of leaving a small opening about one centimetre in length, because the entire pyelotomy incision was covered with a flap of fat taken partly from the fat covering the pelvis of the kidney and partly from the subcutaneous tissue of the original parietal incision. The calculi at the lower pole were easily removed through a small incision extending through the greatly thinned cortex. These two calculi were shaped like the jacks with which children play, and hence the name frequently given to this kind of calculus—"jack stones." The nephrotomy opening was closed with interrupted chromic catgut sutures, and a small transplant of subcutaneous fat placed between the edges of the incision in order to check hemorrhage.

I can warmly recommend the use of fat taken from the subcutaneous layer of the original abdominal incision to control hemorrhage or to reënforce the line of suture of a pyelotomy or nephrotomy incision. This fat contains a ferment which greatly aids the coagulation of blood, and is not only invaluable but is usually at hand. A cigarette drain was placed down to the line of the pyelotomy incision to guard against any possible leak, or to drain away any possible leak of infected urine from the pyelotomy incision.

After an interval of four weeks the left-sided branching calculus was operated upon. In the interval the excretion of urine from both kidneys showed excellent function. The shadow of the left-sided calculus represented a perfect cast of the pelvis proper (Fig. 5) and of the major and minor calyces of the upper and lower poles. Röntgenograms were made of both kidneys on the day preceding the second operation. These showed absence of shadows in the right operated kidney and an unchanged condition of the shadow in the left kidney.

This second operation did not differ, so far as the technic of exposing the kidney and avoiding tearing of accessory vessels were concerned, from the operation performed upon the right side. The conditions met with, however, when the question of removal of

calculi was reached, were quite different. In former times, and it is still the custom of some operators to-day, these large branching calculi were removed through large nephrotomy incisions similar to those made at post-mortem examinations in which the kidney is bisected. The chief objection of operating by this method of nephrolithotomy is that there have been a great many reports of severe bleeding ten to fourteen days after the operation when the thrombi may become loosened and vessels impinging on the line of incision bleed freely. I decided to attempt to remove the greater portion of the calculus through the pyelotomy incision and the smaller portions, occupying the minor calyces, through one or two nephrotomy incisions. I am glad to say that this plan was successful. The calculus was of a branching character and quite large (Fig. 5). I found that the usual pyelotomy incision did not suffice to deliver that portion of the calculus which was located in the pelvis proper and its major calyces, so I resorted to what is known as the enlarged pyelotomy incision by ligating the retropelvic artery so that the entire pelvis, in both its extra and intrarenal portions, was widely exposed. In this manner I was able to remove all of the calculus except two portions which were located respectively in the calyces of the upper and lower poles (Fig. 5). After removal of the main portion of the calculus, I inserted my finger into the pelvis and felt it would be impossible without extensive tearing of the narrow neck of the calyces to remove these calculi which had broken off from the main mass. With one finger, however, in the pelvis to steady these broken off fragments and by making an incision through the cortex, it was possible to remove these fragments very easily through nephrotomy incisions in the upper and lower poles respectively. The enlarged pyelotomy incision could be readily closed with interrupted sutures of very fine chromic catgut, care being taken not to pass through the mucous membrane of the pelvis with the chromic catgut, as this might leave a nucleus for a possible stone to reform on the suture material. A flap of fat was taken from the skin and transplanted over the line of incision in the same manner as I have just described for the right side. The small nephrotomy incisions were closed with interrupted chromic catgut, and as on the right side, a fat transplant placed between the edges.

The abdominal incision was closed after providing for drainage down to the line of sutures in the pelvis of the kidney.

The patient has made an apparent recovery and both kidneys are functioning in a satisfactory manner.

The subject of renal calculi has undergone very rapid changes in our point of view during the past fifteen years, chiefly as the result of improvement in diagnostic methods. A carefully taken clinical history is still of great value, but there are so many other conditions both within the urinary tract and in the organs adjacent thereto which can give rise to the same clinical picture that it would be folly to depend upon the symptoms alone in making a diagnosis.

I will enumerate the principal clinical pictures presented by cases of renal calculus. These are:

(1) Pain, the most prominent symptom;

(2) Symptoms of renal infection predominating, either of an acute or chronic character;

(3) Cases first seen during an attack of anuria;

(4) Patients seen because of an abdominal tumor proved by further examination to be either a hydro- or pyonephrosis; and

(5) The so-called silent cases in which there are no symptoms referable to the kidney.

Let us discuss these briefly:

Group I. *Pain the Principal Symptom.*—This varies both in its intensity and localization. In the majority of patients the pain is felt over one, less often over both, lumbar regions. The pain is of a dull aching character aggravated, as in the case just presented, by exertion. These are the typical cases. In the others the pain radiates either toward the front of the abdomen or downwards along the course of the ureter. In a small proportion of patients we meet with contralateral pain, that is, it is not felt over the kidney where the calculus is located, but on the opposite side.

There is nothing characteristic about the renal pain due to calculus, as was formerly taught. The same pain is found in cases of renal infection not due to stone, less commonly in other renal conditions such as tumors, hydronephrosis and tuberculosis. Hence you must not conclude from the mere presence of pain that it means renal or even ureteral calculus. It is only by the careful examination of the

entire urinary tract in the manner which I will outline shortly, that one is able to more clearly interpret the clinical symptoms.

In cases where the calculus blocks either transitorily or permanently the outlet of the renal pelvis, the pain is of a more severe character, due to an increase in the intrarenal tension. At times the attacks of pain are accompanied by the reflex symptoms such as nausea, vomiting and transitory abdominal distension (reflex renal ileus). This latter symptom leads frequently to an erroneous diagnosis of some acute abdominal (intraperitoneal) condition, because one is apt to forget that there is a close relation between the nerves of the kidney and those of the intestines.

Group II. *Symptoms of Renal Infection.*—In some cases these entirely mask the underlying condition. The patient is seen during a period of which the temperature is high, usually of the remittent type. One often sees cases in which there are one or more cycles of chills, fevers and sweats resembling those of malaria. In cases where there are no localizing signs pointing to the kidney as the source of the infection, it requires considerable diagnostic acumen to think of a renal infection complicating a calculus. In other cases, the symptoms indicative of suppuration around the kidney may predominate. In a third variety the infection is of a more sub-acute or even chronic type and one's attention is only directed to the kidney by finding pus in varying amounts in the urine accompanied or not by other evidences of systemic infection such as fever, high white blood count, etc. Unfortunately, there is nothing pathognomonic about the symptoms of renal infection complicating a calculus to distinguish them from those due to non-calculous condition, and here again the clinical history and ordinary methods of examination must be supplemented by the special ones to be given later.

Group III. *Cases of Anuria.*—Complete suppression of kidney function is more often due to calculus than to any other single cause. There is as a rule, a period of tolerance which lasts on the average from five to seven days, but may be as short as twenty-four hours and as long as twenty-two days. No urine is passed and the bladder is found empty. Mentally the patient is normal, and it is exceptional to find any other symptoms indicative of such a serious condition until this period of tolerance is passed, and convulsions, vomiting,

headache and stupor supervene to show that the uræmic stage has begun. Unless the clinician thinks of the possibility of a calculus blocking one or both kidneys or ureters, the opportunity to save a life passes very rapidly.

Group IV. *Cases Seen Because of an Abdominal Tumor.*—In such patients there is usually a history of one or more attacks of pain as just described, followed by the appearance of an enlargement in the kidney region. This means that a calculus has suddenly become tightly impacted in the outlet of the renal pelvis with resultant hydronephrosis.

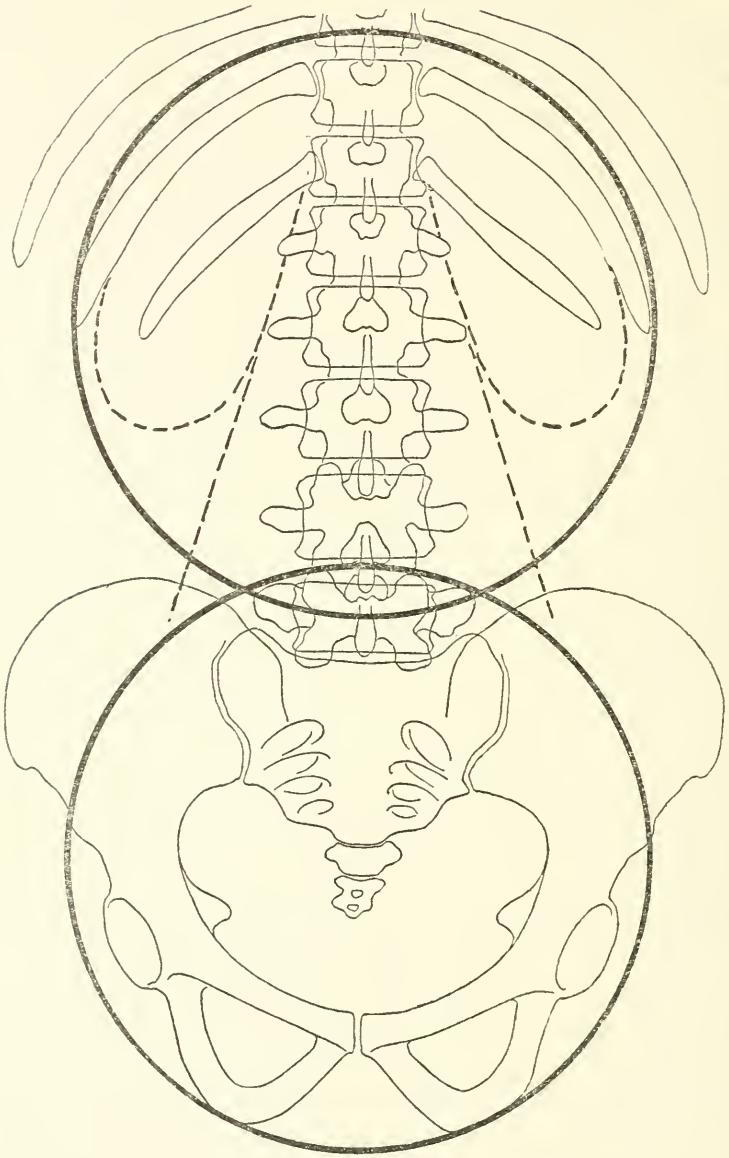
In cases where the tumor is a pyonephrosis the history is that of recurrent attacks of pain accompanied by pyuria and the more gradual appearance of the kidney enlargement. There are, of course, many variations in all of these clinical pictures, but I am attempting to simplify the subject by describing some of the more typical ones.

Group V. *Silent Cases.*—In these, calculi are found, unexpectedly, in one or both kidneys during our routine method of X-ray examination of the entire urinary tract. In other cases, a renal tuberculosis or even tumor is complicated by calculi which caused no specific symptoms. In still others, a hematuria or pyuria leads one to make a thorough examination of the urinary tract and a calculus or calculi are found in the kidneys as the underlying cause. In some of the cases of hydronephrosis due to calculus and described under Group III, the cause of the obstruction, namely, the calculus, is only discovered at operation, having caused no pain when it became impacted.

After having given you this evaluation of the clinical pictures let me call your attention to what should be done with the special diagnostic methods now universally employed for the urinary tract.

(1) *X-ray Examination.*—This should invariably include the entire urinary tract, preferably on two films as shown in Fig. 6, because otherwise it is easy to overlook calculi in the opposite kidney or in one or both ureters. Except in very stout individuals it is now possible to obtain the shadows of both kidneys so that it is not difficult to determine whether the shadows suspected to be calculi are in the kidney, and still further to localize them in the pelvis, calyces or parenchyma. Not every shadow in the kidney region means a renal

Fig. 6.

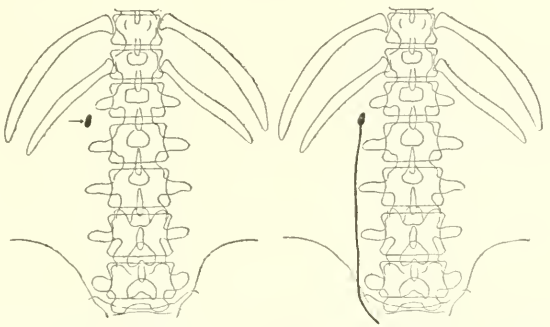


Areas to be included in röntgenograms of the urinary tract. One should be able to see shadows of the last two ribs, bodies of last two dorsal vertebræ, of transverse processes of all the lumbar vertebræ, also shadow of lower two-thirds of kidneys and markings of psoas muscle. Note how the two exposures overlap and also how much of pelvis is included in pelvic film.

calculus. One must differentiate: (*a*) by the appearance of the shadow itself; (*b*) by the use of X-ray catheters (Fig. 7); and (*c*) by pyelography shadows due, for example, to calcified lymph-nodes (Fig. 8), gall-stones, pancreatic calculi or even areas of calcification in a tuberculous kidney fror true renal shadows.

(2) *Pyelography.*—This is extremely valuable in the above differentiation as showing that the shadow is that of a renal calculus

FIG. 7.



In left-hand illustration is seen a shadow in kidney region. Note how X-ray catheter (right-hand illustration) passes up to it, confirming intraureteral or intrarenal nature of shadow.

completely covered by the pyelogram. The latter is also indispensable in enabling one to tell the degree of dilatation of the renal pelvis and consequent destruction of the parenchyma.

(3) *Cystoscopy and ureteral catheterization* to determine the function of each kidney and the degree of any infection when present.

In about 10 to 15 per cent. of all cases the calculus will not show a shadow in the röntgenogram. This is due to the fact that certain calculi such as the uric acid or cystin varieties give very faint shadows. It has been suggested that solutions of the various silver salts be used to intensify such weak shadows.

TREATMENT OF RENAL CALCULI

This is a difficult matter to take up briefly. This is because one's judgment is influenced by many factors such as (*a*) whether there is a single or multiple calculi in one kidney; (*b*) whether they are present in both kidneys; (*c*) whether there are also ureteral calculi present; and (*d*) the condition of the kidney itself.

Based upon a relatively large experience I would formulate the indications for operation as follows:

(1) Remove by operation when unilateral, a single calculus lying in the renal pelvis which has given rise to one or more attacks of pain or which is accompanied by evidences of infection.

(2) Operate for a large branching calculus or multiple calculi if the kidney function tests and pyelograms indicate that there is little destruction of the parenchyma.

(3) In cases of bilateral calculi with well-preserved function, but with accompanying infection, operate—preferably at two sittings.

(4) Do not operate in bilateral cases if there is little parenchyma left and especially if there is still much infection. Recurrence is apt to be rapid in such cases.

(5) Never neglect first to operate on a ureteral calculus completely blocking the opposite kidney before attempting removal of a renal calculus.

Recurrence is the result (*a*) of overlooking calculi at the primary operation, (*b*) of true reformation. The former occurs less frequently since we are able to see the location of the calculus shadows with relation to that of the kidney. True reformation is beyond our control even with all possible care as to diet after operation, drinking of distilled water, lavage of renal pelvis, etc.

Fluoroscopy of the kidney during operation is the ideal method, but few clinics have installed the necessary apparatus.

One should make it a practice to have röntgenograms of the entire urinary tract made within six months, at the latest, after operation.

In spite of great strides in our diagnostic and operative technic, recurrence takes place in from 15 to 20 per cent. of all operated cases.

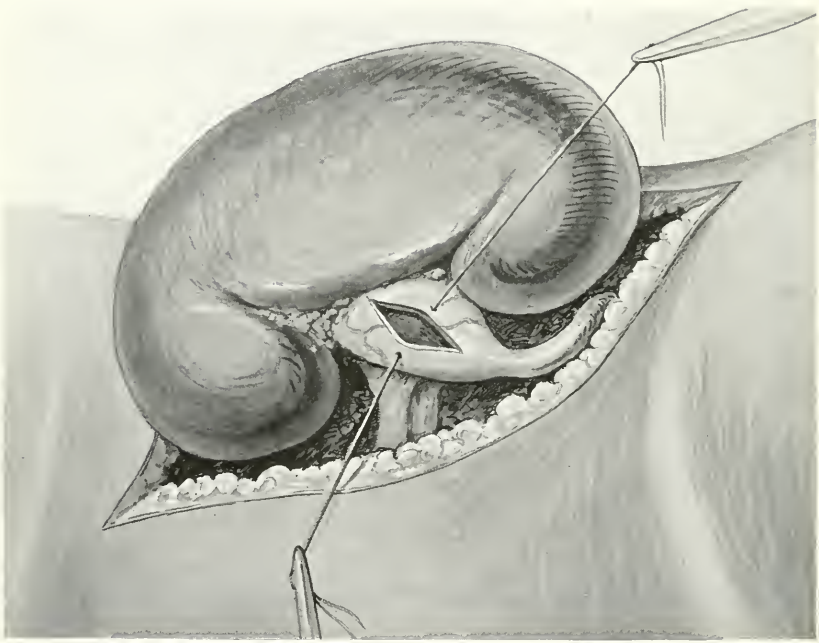
Pyelotomy (Fig. 9) is to my mind the operation of choice, and will succeed in the majority of cases, especially if combined with small nephrotomy incision as in our case to deliver calculi located in secondary calyces or in the parenchyma. Nephrotomy is followed by secondary hemorrhage in 10 to 15 per cent. With the enlarged pyelotomy method as employed in the case I have just presented, even large branching calculi can to-day be delivered where formerly the performance of nephrotomy was the rule.

Removal of the kidney is a last resort, and should only be done where the opposite kidney is intact and the involved organ hopelessly destroyed.

FIG. 8.

X-ray showing shadows in kidney region due to calcified retroperitoneal lymph-nodes. Note irregular character of edges and variations in intensity of shadow, which is characteristic of this form of extra-renal shadow.

FIG. 9.



Posterior aspect of kidney showing the ordinary pyelotomy incision. Two traction sutures of fine catgut or silk are first inserted through the wall of the renal pelvis and incision made between them, as shown in the illustration, upon the calculus. For the enlarging of the pyelotomy, it is necessary to ligate the retropelvic artery and to continue the pyelotomy incision into the renal parenchyma.

THE DIAGNOSING OF ORAL SEPSIS BY RÖNTGENOGRAMS:

WITH ILLUSTRATIVE CLINICAL CASES IN WHICH THE REMOVAL OF THE AFFECTED TOOTH OR TEETH AND THE TREATMENT OF THE DISEASED AREA WAS FOLLOWED BY A DISAPPEARANCE OF THE SYMPTOM-COMPLEX FROM WHICH THE PATIENT WAS SUFFERING

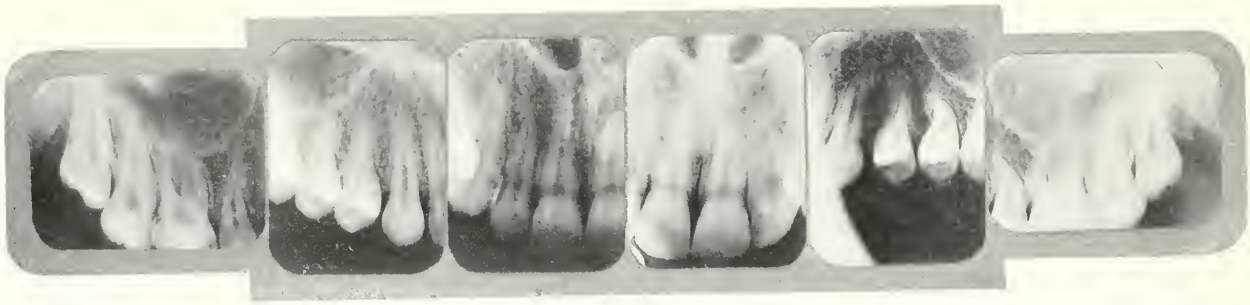
By STERLING V. MEAD, D.D.S.

Professor of Röntgenology in the former Dental Department of George Washington University; Chief, Department of Oral Surgery, Eastern Dispensary and Casualty Hospital, Washington, D.C.

In my paper in the last issue of the INTERNATIONAL CLINICS I stated that "Local manifestations of oral sepsis. . . .are to be found in three out of every five adults seeking medical or dental aid when their mouths and adjacent structures are properly examined, while two out of every three of those so affected will have sufficient evidence of harmful systemic infection to demand careful local and general treatment by those competent to give it." In this article, mostly made up of illustrations, I shall endeavor to show how the diagnoses are made from the X-ray pictures, and will cite a number of brief illustrative histories in which the subjective and objective symptoms from which the patient was suffering—often of long duration—were quickly relieved upon the removal of a diseased tooth or teeth which outwardly had caused little or no manifestations of pain, swelling or other discomfort. Such cases as those here given could be multiplied by the hundreds from my records, and cannot be considered by any one seeing the beneficial results as being cures of a *post hoc, propter hoc* nature. A visit to any competent dentist doing similar lines of work to that described, will convince any fair-minded physician that his duty to his patient is not completed without a careful examination of the mouth for possible oral sepsis as a cause of the condition for which the patient is seeking treatment. A close co-operation between the physician and dentist in treating this class of cases will yield benefits to those patients seeking relief of a most striking and serviceable nature.

Negative skiagraphs of upper set of normal teeth.

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6.



Complete set of skiagraphs of the entire mouth, showing position of the film and the number of teeth upon each film to be taken in order to obtain good results. This full set of eleven X-ray pictures was taken of a normal mouth, with normal gingivæ and with no dental pathology, with the exception of slight open contact point between upper right cuspid and first bicuspid and of slight impaction of lower third molars. These skiagraphs should be studied before undertaking the examination of the remaining illustrations.

Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 11.

Negative skiagraphs of lower set of normal teeth.

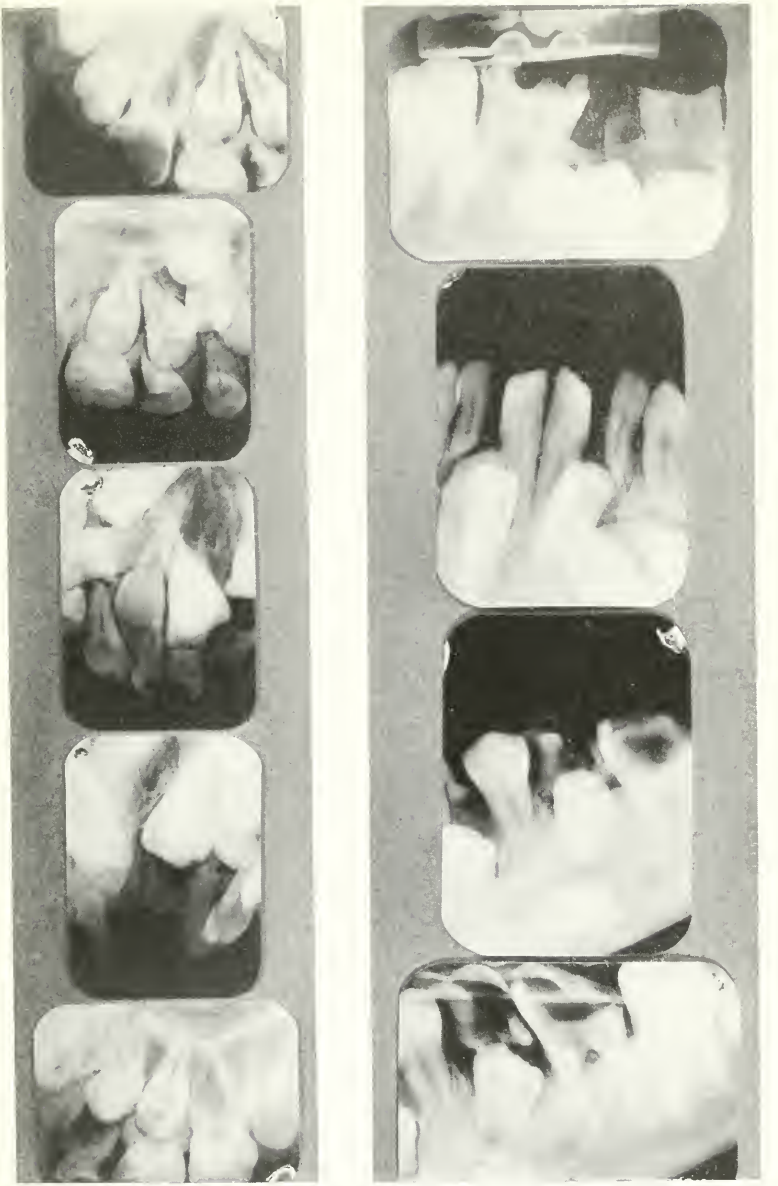


Fig. 12. Fig. 13. Fig. 14. Fig. 15. Fig. 16. Fig. 17. Fig. 18. Fig. 19. Fig. 20.

Miss W., aged 14 years. A well-developed case of rickets in which seven permanent teeth have erupted, with numerous unerupted teeth, some of which are supernumerary. Compare the helter-skelter arrangement with Figs. 1 to 11.

Fig. 21.

Fig. 22.

Fig. 23.

Fig. 24.

Fig. 25.

Fig. 26.

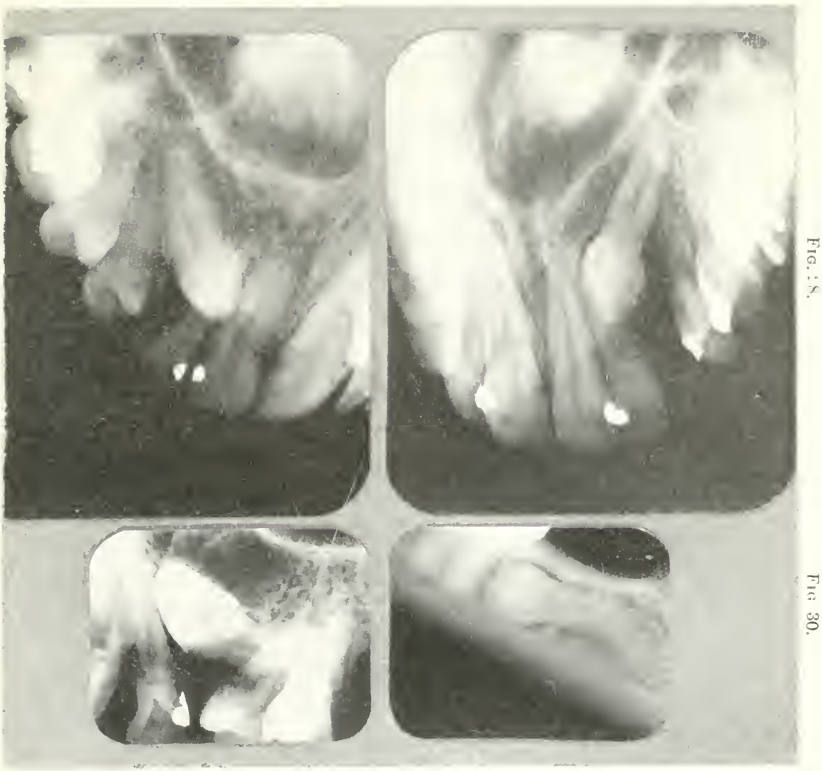


Fig. 27.

Fig. 28.

Fig. 29.

Fig. 30.

Fig. 21 shows absorption of roots of upper central and lateral teeth. The root of the central has been almost completely destroyed, leaving the metal pin and gutta percha root-canal filling exposed.

Fig. 22 shows upper temporary cuspid of which the root has been absorbed. This is an illustration of physiological absorption where the bone has regenerated as the root has become absorbed.

Fig. 23 shows absorption of apices of roots of lower second molar caused by impacted third molar. The second molar tooth was vital.

Fig. 24 shows circumscribed type of periapical infection upon lower second bicuspid tooth. Canal unfilled and instrument broken off near apex.

Fig. 25 shows circumscribed type of periapical infection of upper central incisor. Root canal unfilled.

Fig. 26 shows circumscribed type of periapical infection of lower second bicuspid. Tooth has gold crown, partially filled canal, and area of bone absorption is about the size of a pea. The dark area shown below is shadow from outline of mental foramen. (For the cuts of Figs. 21 to 26 inclusive, see p. 260.)

Figs. 27-29. Different types of impacted cuspid teeth.

Fig. 30. Unerupted cuspid tooth.

Fig. 31.

Fig. 32.

Fig. 33.

Fig. 34.

Fig. 35.

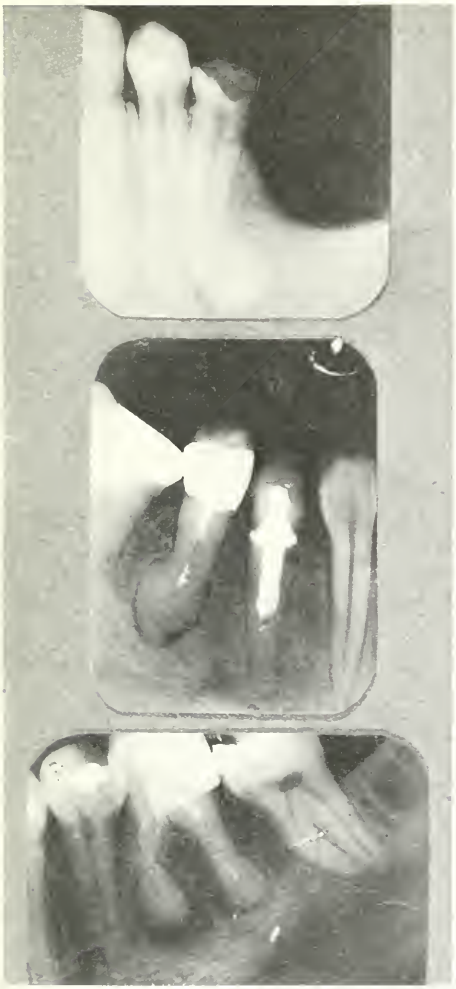
Fig. 31. Lower impacted third molar of the straight type.

Fig. 32 shows view of impacted third molar with lingual displacement taken in the usual way for lower molars. No roots are shown. The second molar shows periapical alveolar absorption.

Fig. 33 shows another view of same case but the tube set as if taking an upper third molar. This brings out the root formation, as in the lingual displacement the crown of the tooth lies toward the inner plate of mandible and the root lies horizontally outward or buccally.

Fig. 34. Lower impacted third molar. Horizontal type, lying distally to second molar with only slight buccal overlap. Completely covered with bone, but with slight absorption above crown.

Fig. 35. Follicular cyst surrounding a lower undeveloped and unerupted third molar, surrounded by bone absorption and cyst wall. Patient complained of general malaise and underweight. After removal of this tooth patient gained 15 pounds. The contents of cyst consisted of yellow liquid surrounded by cyst walls. The virulence of organisms in this case was increased by reason of communication with mouth proper through area of bone absorption.



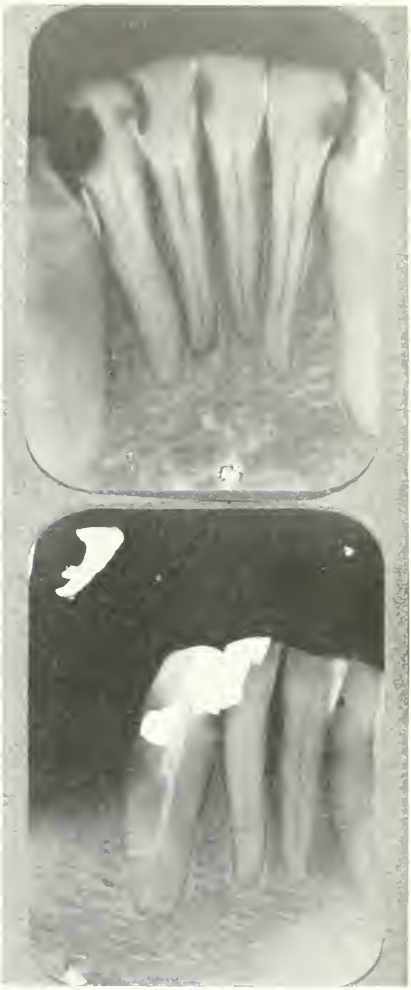


Fig. 36.

Fig. 37.

Fig. 38.

Fig. 39.

Fig. 40.

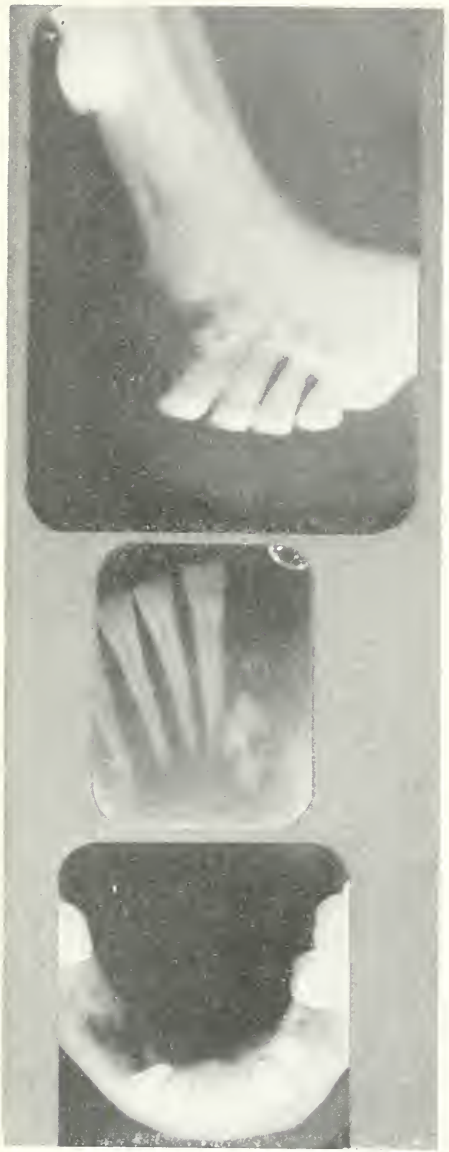
Fig. 36. Excementosis of root of lower vital bicuspid, showing no infection.

Fig. 37. Excementosis of root of lower bicuspid tooth. The tooth is pulpless, and has partial root-canal filling.

Fig. 38. Excementosis of lower first molar tooth. This tooth is pulpless, with partial root-canal filling; extensive periapical alveolar absorption also seen.

Fig. 39. Caries in lower anterior teeth. All these teeth are vital except left lateral.

Fig. 40. Caries of lower cuspid. A cavity is seen distally under the margin of the gingiva. A plate was worn in the mouth with a clasp attached to this tooth. When view was taken there was only slight gingival irritation, and patient was advised to have the tooth extracted. Patient returned one year later with carcinoma over this area, the irritation best accounting for the causation of the tumor.



FIGS. 41 and 42. Necrosis. Case Mr. B. Radiograms show the irregular and indistinct outline of bone absorption with the sequestrum. There was slight swelling, extreme pain, characteristic yellow liquid, temperature 102° F.

FIG. 43. Same case as shown in Figs. 41 and 42 immediately after removal of sequestrum.

Fig. 44 shows pulp stone in lower first molar.

Fig. 45 shows pulp stone in lower first molar and has a projection extending into root-canal. This tooth became very painful, and it was necessary to extract it.

Fig. 46 shows piece of salivary calculus in submaxillary duct. There was slight swelling and soreness under the tongue.

Fig. 47 shows abrasion of occlusal surfaces of lower bicuspids and first molar teeth

Fig. 48.

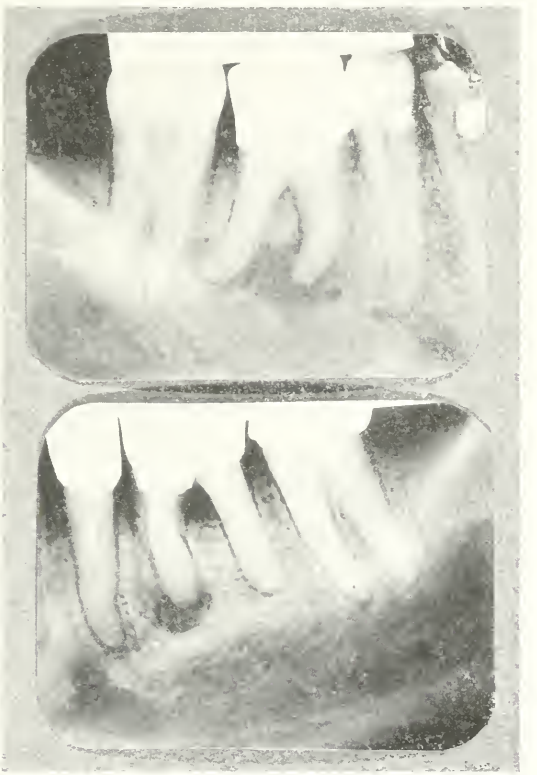


Fig. 49.

Figs. 48 and 49. Case Mrs. W.—Was referred by her physician to her dentist. Her dentist advised her that her teeth were in perfect condition. Radiograms were taken of the teeth. Fig. 48 shows lower left first molar to have periapical alveolar absorption. Bicuspid is vital and area shown below apex is due to shadow from mental foramen. Fig. 49 shows periapical alveolar absorption lower right second bicuspid and first molar. Shadow from mental foramen is also shown below bicuspid and the inferior dental canal is also shown. The left first molar and right bicuspid and molar were extracted, which completely relieved the lumbago with which she had suffered six weeks.

Fig. 50.

Fig. 51.

Fig. 52.

Fig. 53.

Fig. 50. Calculus on mesial surfaces of roots of lower central incisors. Open contact point and osteoclasia are also shown.

Fig. 51. Showing the use of the radiogram in the practice of orthodontia where unerupted central tooth is being brought into position.

Fig. 52. View of teeth shown in Fig. 53 taken at the same sitting, but from another angle. Perforation is *not* shown. This shows the value of more than one radiogram in cases of this kind, and the possibility of misinterpretation from radiograms.

Fig. 53. Perforation of root by post for retention of crown. Area of alveolar absorption is well-shown.

FIG. 54. FIG. 55. FIG. 56.

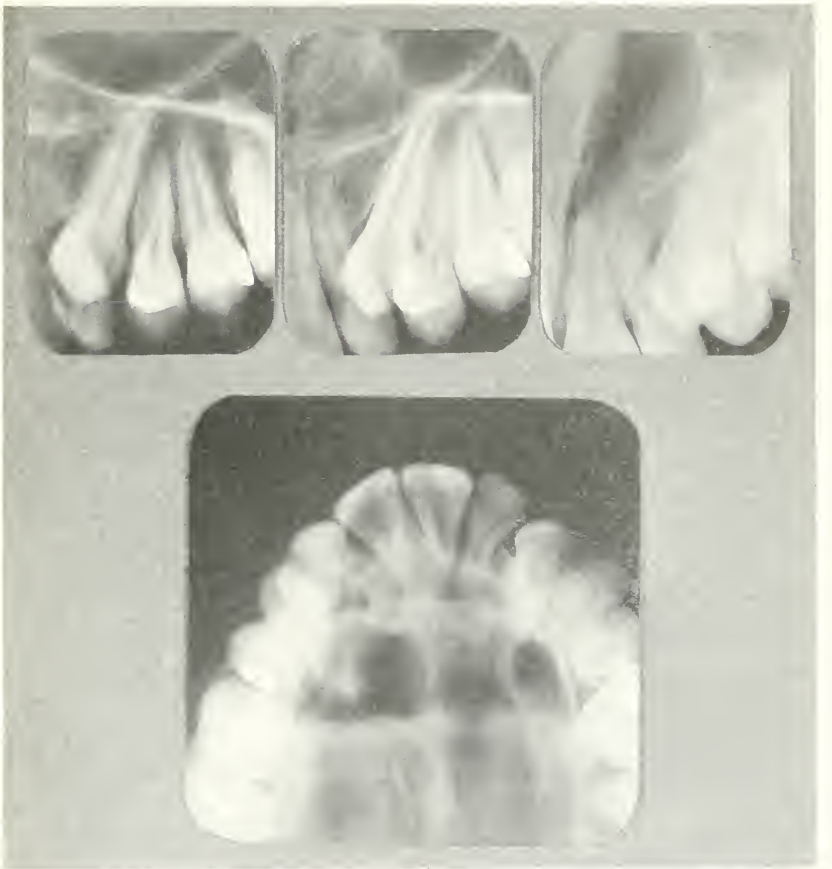


FIG. 57.
Localization—Impacted upper cuspid tooth.

FIG. 54 shows view taken anteriorly.

FIG. 55 shows view taken further posteriorly.

FIG. 56 shows view taken still further posteriorly.

Rule: Since the impacted tooth appears to move posteriorly as the angle is changed further posteriorly the tooth will be found to be upon the buccal side of the other teeth.

FIG. 57 shows view taken with target of tube at right angles to film held between the teeth and the impacted tooth is shown outside of the other teeth or buccally to them.

Fig. 58. Fig. 59.

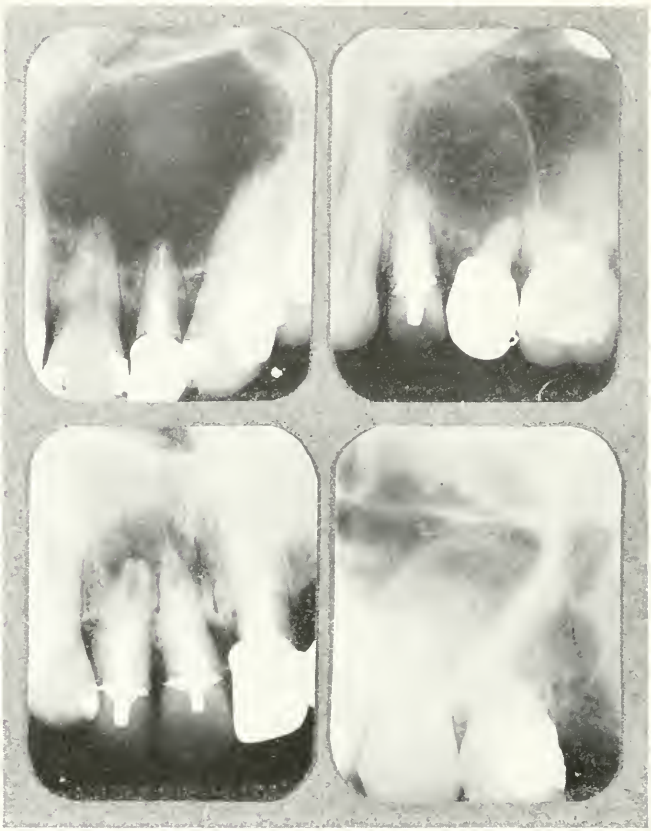


Fig. 60. Fig. 61.

Fig. 58. Radicular cyst of upper maxilla, size of a fifty-cent piece, and caused by periapical infection. All the pulpless teeth were removed at the time of operation.

Fig. 59. Radicular cyst of upper maxilla, size of a twenty-five-cent piece, which borders the nasal cavity and the maxillary sinus. Caused by periapical infection. Three teeth were removed at time of operation.

Fig. 60. Radicular cyst about the size of a grain of corn, and involving upper central and lateral teeth. Both teeth were removed.

Fig. 61. Radicular cyst size of a twenty-five-cent piece, involving upper molar teeth. The outline of this cyst and the area of absorption of bone is not as clearly defined as in the other cases cited. This is due to the posterior position in the mouth, and the difficulty of showing the full outline without the rays passing through the molar bone.

Fig. 62.

Fig. 63.

Fig. 64.

Fig. 65.

Fig. 66.

Fig. 67.

FIGS. 62 to 67. Periapical infection. These views show diffuse type of periapical alveolar absorption due to infected teeth.

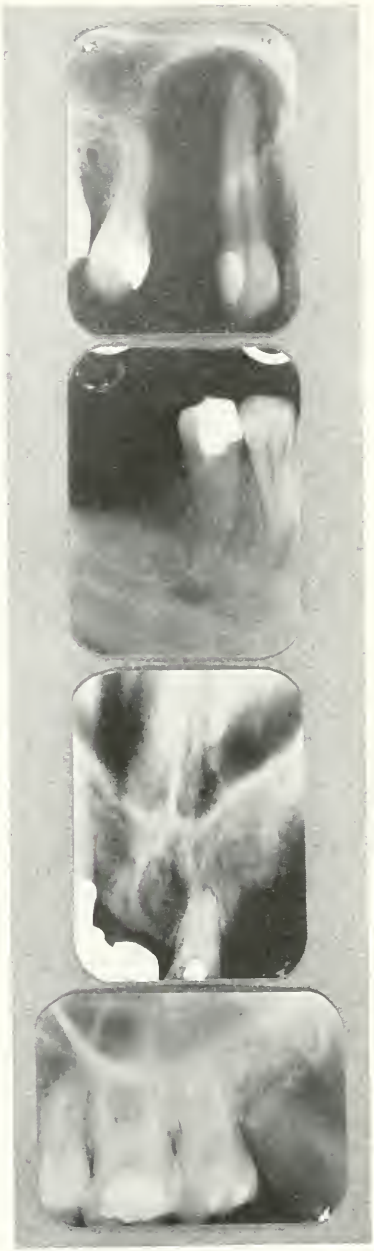


Fig. 68.

Fig. 69.

Fig. 70.

Fig. 71.

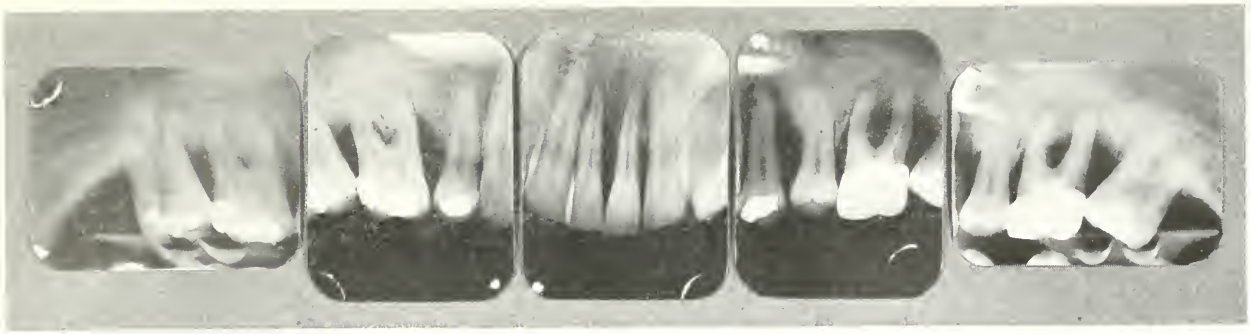
Fig. 68 shows area of alveolar absorption size of a twenty-five-cent piece which appears to involve the cuspid tooth. This area was caused by a diseased lateral tooth, which was extracted. The cuspid tooth is vital, and the area of bone absorption is lingually to the apex of the tooth. The vitality of the cuspid was determined by pulp-tester and by drilling into the tooth for sensation. Areas of this nature which appear to overlap the roots of vital teeth are often the cause of misinterpretation of radiograms.

Fig. 69 shows view of lower bicuspid tooth, from which the nerve has been removed with partial root-filling. The radiolucent area below the apex of this tooth is caused by the mental foramen, and this condition is often the cause of misinterpretation of radiograms.

Fig. 70 shows upper central tooth and an approximating radiolucent area, size of a dime, caused by the anterior palatine foramen and also a larger radiolucent area caused by the nasal cavity. These shadows are often misinterpreted.

Fig. 71 shows radioparent object distally to second upper molar, caused by the maxillary tuberosity. This is often misinterpreted for impacted third molar.

Fig. 72. Fig. 73. Fig. 74. Fig. 75. Fig. 76.



Figs. 72 to 82. Case Mrs. Y. The following teeth show periodontal involvment:

Fig. 72. Upper right last molar.
Fig. 73. Upper right second bicuspid.
Fig. 77. Upper left last molar.
Fig. 79. Lower right first bicuspid.
Fig. 80. Lower right central.
Figs. 81 and 82. Lower left first molar.

The following teeth show periapical alveolar absorption:

Fig. 77. Upper left first molar.
Fig. 78. Lower right first molar.

The remainder of the teeth shown in views 73, 74, 75 and 76 being normal. No local manifestations of pain or discomfort about the teeth. Patient complained of general malaise and loss of weight. The diseased teeth were all extracted.

Radiograms of the same case taken 25 months later, showed regeneration of bone in areas where teeth had been extracted. Patient reported she had received no medical treatment during this period of over two years and reported a gain of 50 pounds in weight. She stated she had been immediately relieved of her general malaise.

Fig. 77. Fig. 78. Fig. 79. Fig. 80. Fig. 81. Fig. 82.

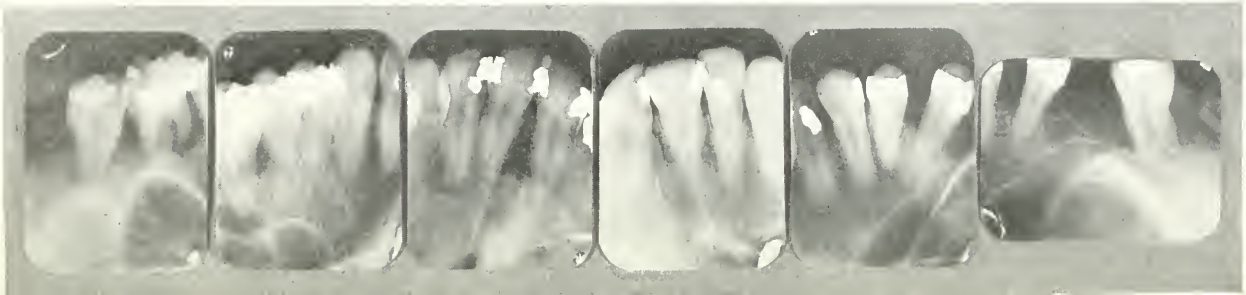


Fig. 83.

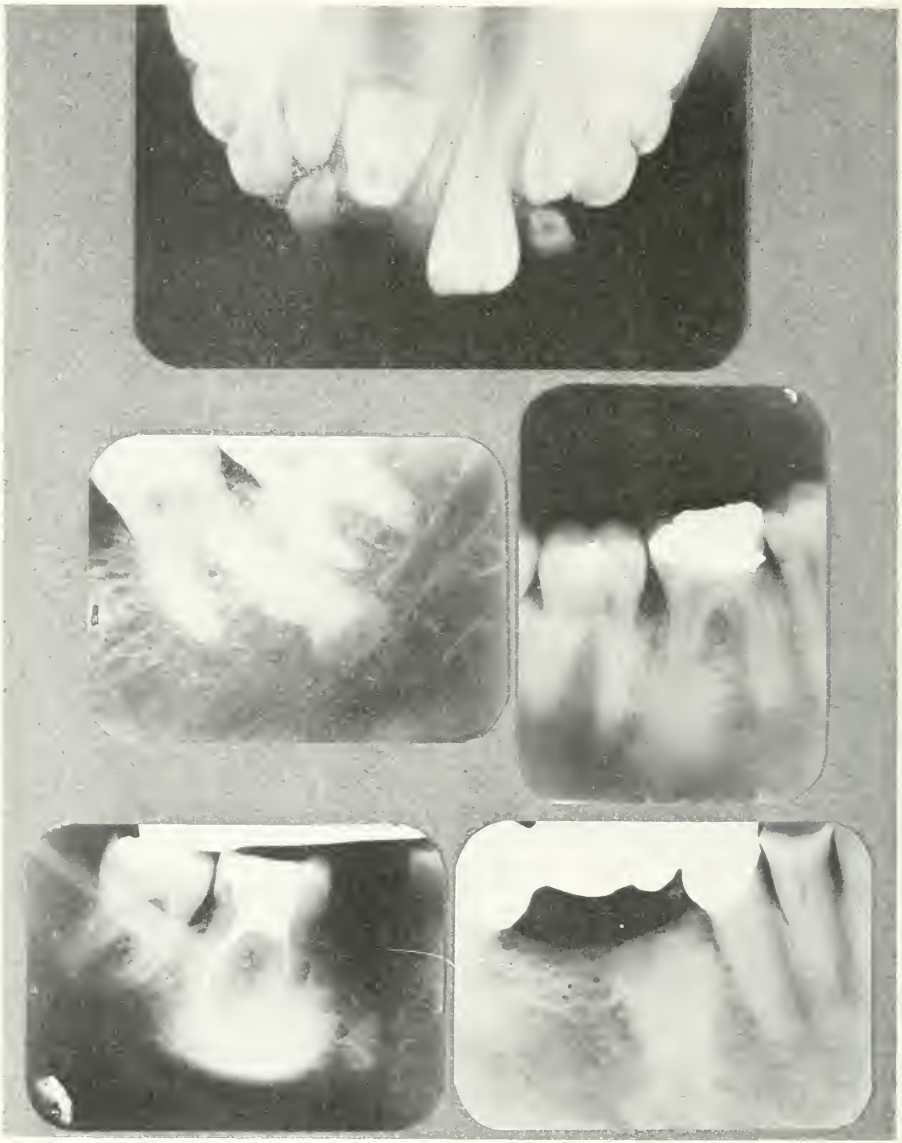


Fig. 84.

Fig. 86.

Fig. 85.

Fig. 87.

Fig. 83. Upper central tooth unerupted, undeveloped and misplaced.

Fig. 84. Osteosclerosis, below apex of distal root of lower first molar. Tooth vital.

Fig. 85. Osteosclerosis, at apices of roots of lower second molar at site of previous area of apical infection. Molar devitalized and partial root-filling.

Fig. 86. Osteosclerosis, at distal root of vital lower first molar.

Fig. 87. Osteosclerosis in alveolar socket where tooth had been extracted.

Fig. 88. Fig. 89.

Fig. 90.

Fig. 88 shows absorption of apex of root of upper cuspid tooth, due to periapical infection. Area of alveolar absorption or radiolucent area.

Fig. 89 shows apex of upper first molar in the maxillary sinus, where it had been pushed in an attempt at extraction.

Fig. 90 shows absence of permanent upper lateral incisors. Cuspid teeth are erupting next to central teeth.

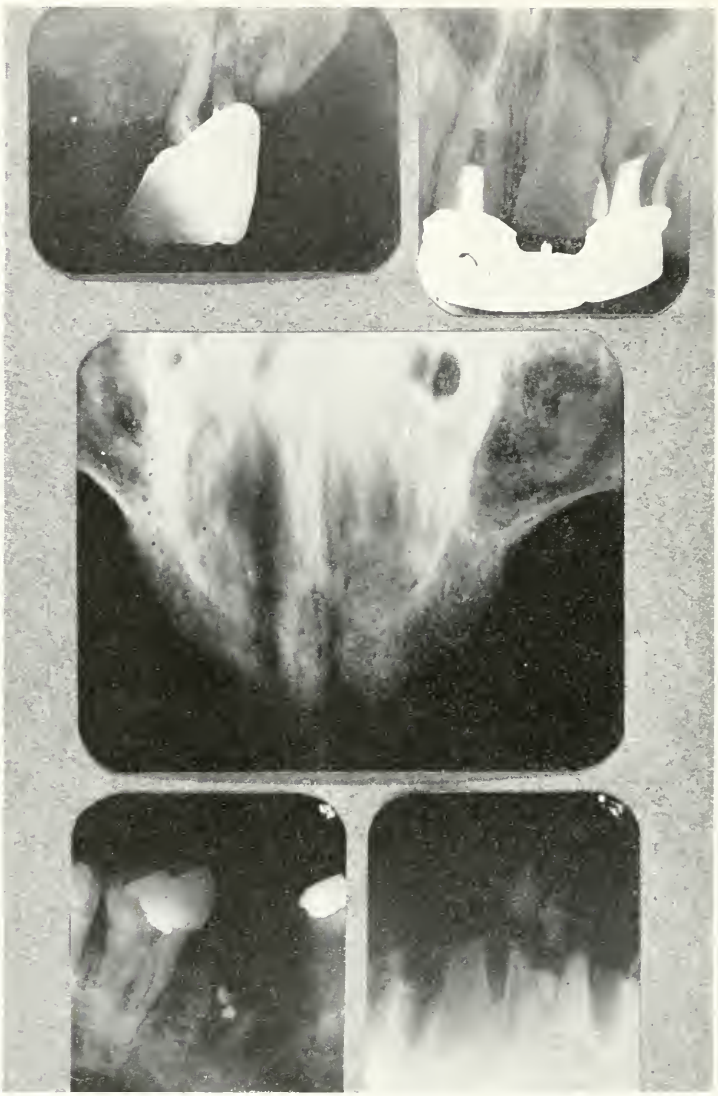


Fig. 91.

Fig. 92.

Fig. 93.

Fig. 94.

Fig. 95.

Fig. 91 shows ill-fitting gold crown and periapical alveolar absorption.

Fig. 92 shows uncrupted central tooth under fixed bridge, and demonstrates the necessity of radiograms before attempting restorations.

Fig. 93. Radiogram of upper mouth taken to determine if all teeth and roots were removed. There is no pathology shown.

Fig. 94 shows pieces of filling material which have fallen into the distal socket of first lower molar after extraction.

Fig. 95 shows pieces of root in socket of anterior lower tooth and also loose pieces of bone after extraction.

FIG. 96. Odontoma. The odontoma was made up of two upper third molars grown together. Patient complained of neuralgia, which was relieved upon removal of the odontoma.

FIG. 96.

FIG. 97. Periapical alveolar absorption — circumscribed type. Lower second bicuspid. Dental broach broken off in canal near apex.

FIG. 97.

FIG. 98. Absorption of roots of upper central, lateral and cuspid teeth. Central shows periapical alveolar absorption. Lateral was a vital tooth. Cuspid still vital although part of the root absorbed.

FIG. 98.

FIG. 99. Lower deciduous molar with crown shows root absorption and regeneration of bone.

FIG. 100. Upper second and third molars are vital, but show imperfect formation or partial absorption of crown and root.

FIG. 99.

FIG. 101. Lower second bicuspid shows absorption of apex.

FIG. 100.

FIG. 101.

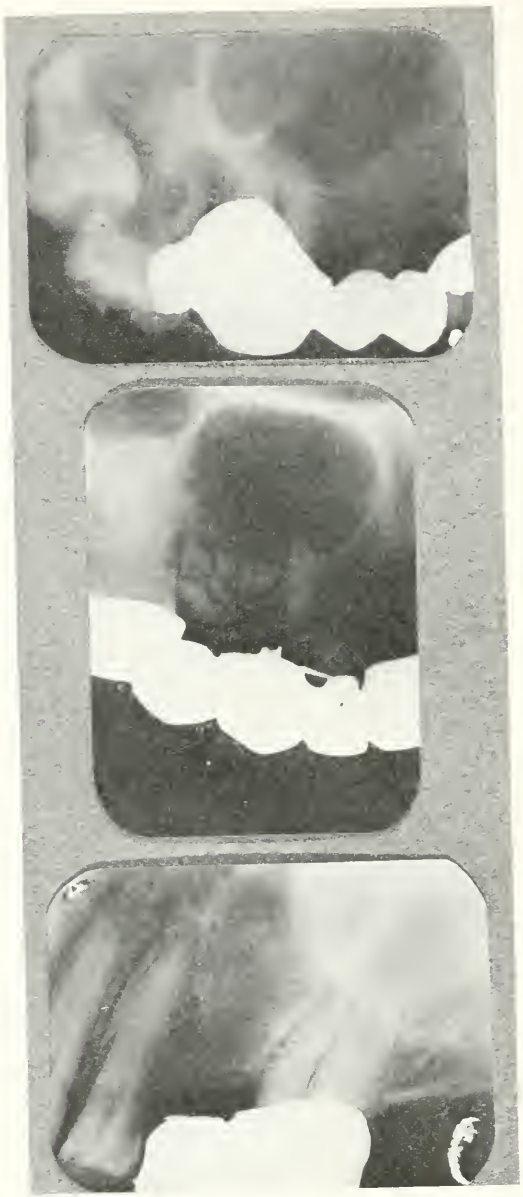


Fig. 102.

Fig. 103.

Fig. 104.

Fig. 102. Case Mrs. S. — Impacted third molar (to left of picture) has caused death of pulp in upper second molar. Upon extraction of the second and third molars necrotic bone was found. Examination showed cystic formation and degenerate polypi resembling large roe of fish. Patient had no local disturbance at the time, although she had previously been treated for reflex pains about frontal sinus region. She was suffering from severe nervous disorders and depression. Relief was almost immediate, and there was complete recovery within three months.

Fig. 103. Case Mrs. A.—Cyst caused by root left under fixed bridge. Cultures on placenta-infusion agar and human blood-agar plates showed *Streptococcus hæmolyticus* in large numbers; and an occasional colony of *Staphylococcus albus*. There were no local disturbances, but the patient complained of general malaise and impaired vision. Complete recovery after treatment.

Fig. 104. Case Mr. B. — Upper left second molar, the abutment showing deep mesial periodontoclasia, and no definite periapical involvment. Upon extraction a thick yellow pus was found between the roots, and the bridge was in a very unsanitary condition. Cultures on placenta-infusion agar and human blood-agar plates showed *Streptococcus hæmolyticus* and *veridans* in about equal proportions. Patient was referred by physician because of pain in left ear, which was relieved immediately after extraction of the tooth.

Fig. 105.

Fig. 106.

Fig. 107.

Fig. 108.

Fig. 105. Case Mr. B.—Periapical alveolar absorption around upper left first molar. Cultures on placenta-infusion agar, placenta-infusion broth and human blood-agar plates showed *Streptococcus hæmolyticus* and *viridans* in large numbers. There was local tenderness over the area, with general malaise and gastric disturbances, all of which disappeared completely after extraction.

Fig. 108. Case Mr. B.—Radicular cyst caused by infection from upper left second molar. The outline of the cyst is very indistinct because of the shadow from the malar bone and approximation of the maxillary sinus, which was involved in the cyst. There was slight local pain. Patient complained of general depression and impaired vision of long standing, which was completely cured within two months after operation.

Fig. 107. Case Miss McM.—Diffuse periapical alveolar absorption lower right second molar. Cultures on placenta-infusion agar and human blood-agar plates showed *Streptococcus viridans* predominating with *Staphylococcus albus* and *micrococcus catarrhalis* also present. Severe facial neuralgia and general nervous disturbances of long standing disappeared within one month.

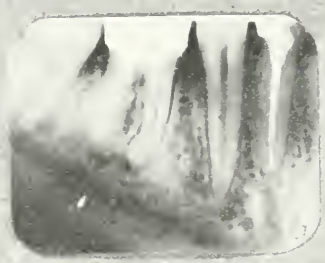
Fig. 108. Case Mr. W.—Skiagraph shows only slight periodontoclasia, distal to lower left first molar. A number of views gave the same result. While radiographic findings were almost negative, and there was only very slight bone involvment shown, clinical observation disclosed a deep gingival pocket on the lingual side of the tooth, extending between second and third molars, almost to the apices of the roots. Patient gave history of acute abscess in this position about two months previous. Complained of severe headache in back of head which had existed for over two months with no apparent cause. After removal of this tooth there was immediate restoration to health.

Four examples of well-marked affections, three of them of long standing, diagnosed and treated by competent physicians without benefit, in which the symptoms immediately disappeared after the extraction of a diseased tooth which had given no local manifestations of pain, swelling, discoloration or cavity.

Fig. 109.

Miss M. E. H.—Skiagraph of upper central tooth, which was apparently vital and had given rise to no local symptoms whatsoever. There will be noted in Fig. 109 a radiolucent area caused by alveolar absorption, which starts from an open contact point between the cuspid and the central teeth, the latter being missing. An acute iritis had developed in left eye, and cleared up immediately after extraction of this tooth. (Fig. 109.)

Fig. 110.



Miss M. G.—Lower right first molar, which gave no history of pain, swelling or discomfort, the area of infection having been located by skiagraphs of full mouth. For three months previous the hearing and the eyesight had been markedly affected: hearing and eyesight restored within three days after extraction of this tooth. (Fig. 110.)

Fig. 111.

Mr. D.—Upper left second bicuspid, there being no local manifestations from any of his teeth. He was suffering from neuritis of the left arm, which had existed for six months, and the arm was useless. Complete recovery within four days after extraction of the diseased tooth. (Fig. 111.)

Fig. 112.

Mrs. C. G. A.—Lower left second molar. Teeth gave no local manifestations of trouble. There was a history of neuritis of the left arm of five years' standing, the arm being practically useless at this time. Complete recovery upon extraction of this tooth, within one week. (Fig. 112.)

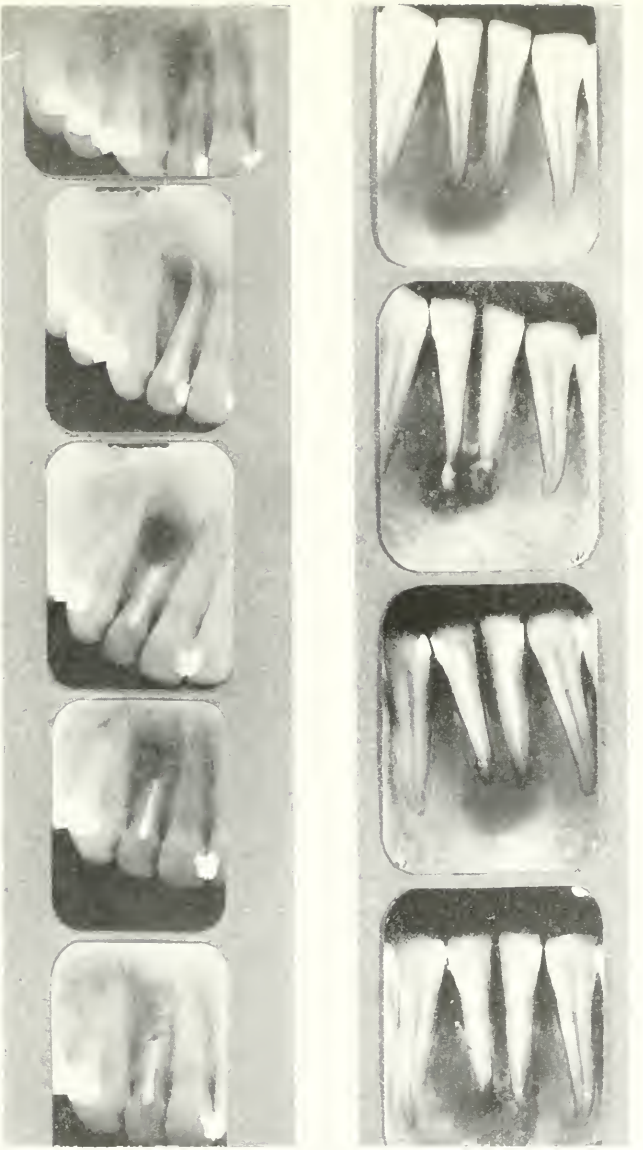


Fig. 113. Apicoectomy, showing alveolar absorption at apex of upper lateral tooth. Fig. 114, root canal filled. Fig. 115, after operation. Fig. 116, condition one year later, showing regeneration of bone. Fig. 117, condition 18 months after operation, showing complete bone regeneration. Fig. 118, periapical alveolar absorption of lower central teeth. Fig. 119, root-canal filling extending through apices of roots. Figs. 120 and 121, result immediately after operation

Figs. 120 and 121 were taken immediately after the operation and show how careful one must be in making interpretations from radiograms, as in Fig. 120 the operated area is the size of a dime while in Fig. 121, taken from another angle, the operated area is no larger than a pea, the latter result being caused by improper angulation in taking radiogram, the shadow from the normal portion of the mandible giving the area of bone absorption the appearance of regeneration.

Fig. 122.

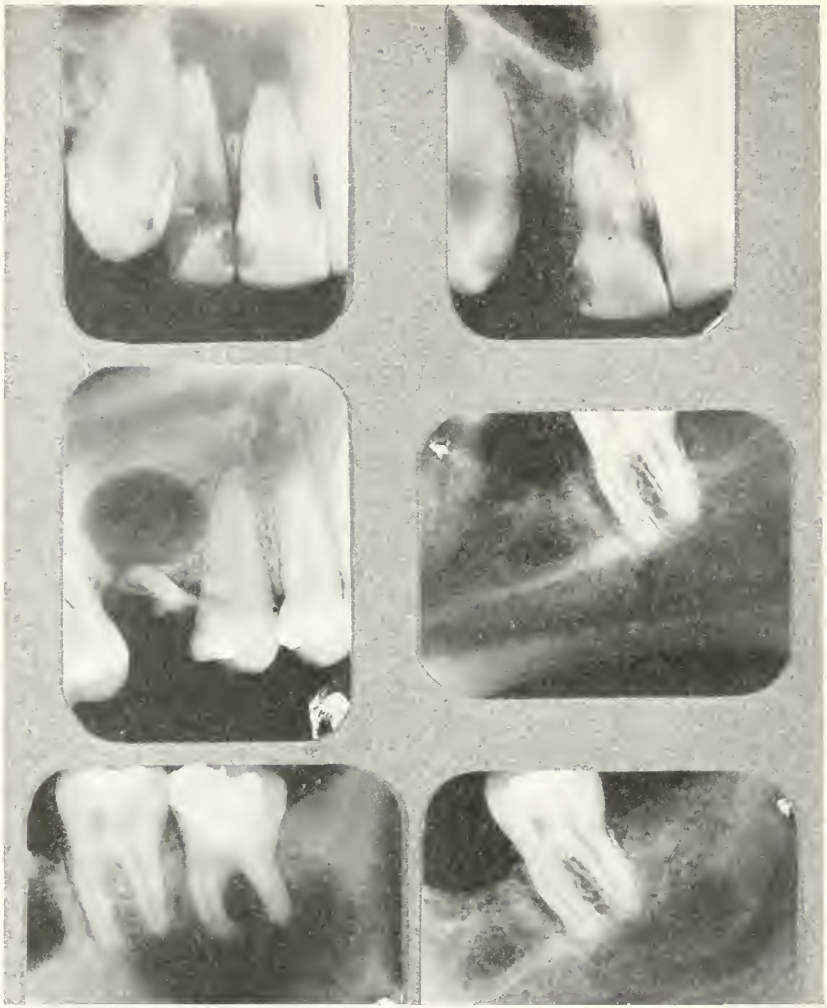
Fig. 123.

Fig. 124.

Fig. 125.

Fig. 126.

Fig. 127



Figs. 122 to 127. Mr. B. had suffered for 15 years from heart involvment consisting of marked cardiac hypertrophy, a blood-pressure of 215 mm., and heart-beats noticeable through his outer garments. He had been rejected by the draft-board on account of his heart condition. Fig. 122 shows upper right lateral with an area of periapical alveolar absorption the size of a one-cent piece, apparently involving the central tooth, which tested vital by pulptester. The lateral tooth was removed, leaving the central one. Fig. 123 shows the result of bone regeneration two years later, the central tooth being normal. Fig. 124 shows piece of root in lower left first molar region and radicular root-cyst size of a dime. Fig. 125 shows result of bone regeneration two years after the extraction and operation. Fig. 126 shows lower left second molar with periapical alveolar absorption and radicular cyst size of a twenty-five-cent piece. Fig. 127 shows result of bone regeneration two years after treatment.

These areas of infection were operated upon at three different sittings, one week apart. Within two weeks after the last area was treated the blood-pressure had dropped to 155 mm.; after six months it was 135 mm., and has remained at about this point for the last three years. The heart condition has been greatly relieved. Patient has gained 25 pounds in weight.

THE SCOPE OF USEFULNESS OF WOUND SMEARS TO THE SURGEON*

By EDWARD P. HELLER, M.D.
AND
SAMUEL VOEGELIN, M.D.
Kansas City, Missouri

An article in the International Clinics by D. P. D. Wilkie,[1] of Edinburgh, aroused our interest in wound smears, and we have made smears of exudates, transudates, and secretions on the least provocation. The practice has been so valuable that we wish to take this occasion to illustrate the wide range of applicability by presenting an average series of smears made from surgical patients in the service of Dr. John G. Sheldon, during a recent short period.

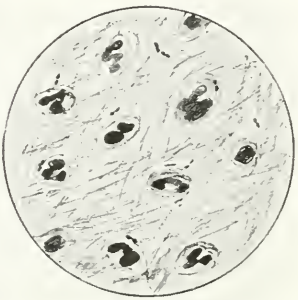
Wilkie endeavored to point out the value, in giving a prognosis in a certain case—for instance of general peritonitis—of knowing the type of infection and the apparent resistance of the individual to that infection. These two points he determined by staining films of the exudate immediately after operation—or having them stained while the operation was still in progress—in order to make certain that sufficient drainage was being instituted and that everything was technically propitious for the recovery of the patient. His point is certainly well taken that "the important point for the surgeon and patient *is not the name or the cultural characteristics of the invading germ, but its relative virulence for the particular individual.*"

During and just prior to the recent World War surgeons were wont to rely on the bacterial count to determine the time for secondary suture of wounds, and to control the antiseptic solutions used in infected wounds. In the numerous works dealing with the bacteriology of war-wounds, scarcely a word is said about the type and proportion of the various phagocytic cells of the body present in the smears of infected wounds. While studying a number of infected wounds in the surgical service of Doctor Deaver in the Lankenau Hospital of Philadelphia in 1919, one of us (E. P. H.) had an excellent opportunity to try out Wilkie's method, while, at the same time, conclusions were being formed as to the relative merits of several hypochlorite solutions.[2]

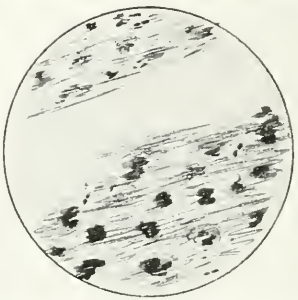
* From the Surgical Service and Department of Pathology of the Vineyard Park Hospital.

Case No. 681.—Patient entered hospital on February 3, 1922, complaining of pain in left chest and profuse expectoration. Present illness began December 4, 1921, with pneumonia, left lobar, which subsided in nine days. Then was up and about for ten to fourteen days, when fever, sweats, and pain in left chest began. Two days prior to admission, he expectorated a large quantity of purulent material, and felt relieved. Physical signs were those of abscess in left lobe. Temperature, 99° F. Leucocytes, 9200. No operation. Recovery complete.

Fig. 1.



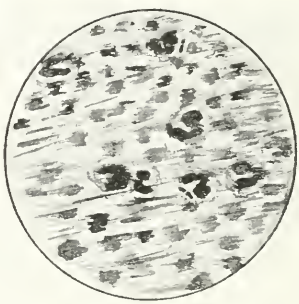
Case No. 681. (Mr. J. E. S., age 36.) Abscess of left lung. Smear of pus evacuated per oram. February 4, 1922. Pure culture of *Pneumococcus*.



Case No. 745. (Mr. O. R., age 17.) Left thoracic empyema. Thoracotomy, smear of pus evacuated February 28, 1922. Pure culture *Pneumococcus*.

Case No. 745.—Patient was admitted to the Vineyard Park Hospital five weeks after an attack of lobar pneumonia, in which the temperature went down by lysis, gradually merging into symptoms of empyema. Entire left chest was filled with thick, greenish pus. After operation, the patient ran a septic temperature for twenty-one days, reaching normal at that time. Tube still *in situ*. Pus evacuated showed very few organisms, and rather disintegrated cells poor in phagocytic power. The sputum, of which there was very little, was absolutely free of organisms.

Case No. 659. (Mr. G. W., age 33.) Acute right mastoiditis. Simple mastoidectomy; tonsillectomy, January 24, 1922. Smear from sero-sanguinous discharge shows *Pneumococcus*, some in chains (*Streptococcus mucosus*).

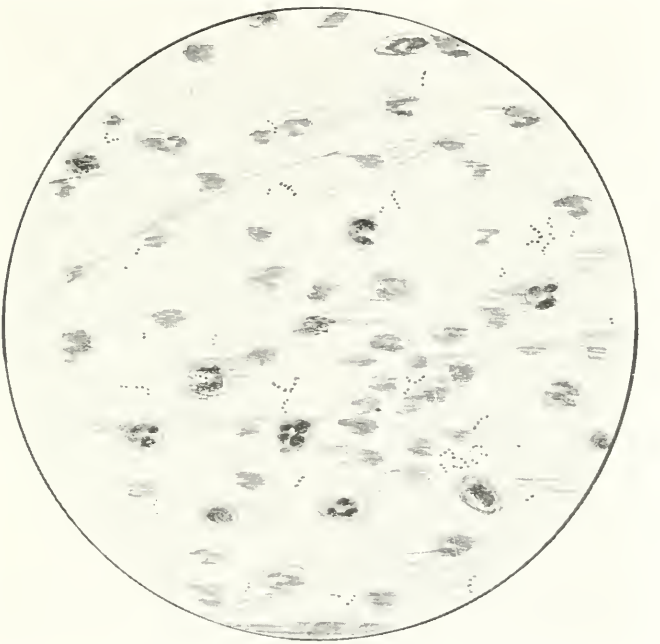


Case No. 764. (Mrs. G. D., age 36.) Pelvic abscess. Posterior vaginal colpotomy, March 7, 1922. Smear of pus shows a very few *Pneumococci*.

Case No. 659.—Patient was operated on thirty-six hours after onset of an acute right mastoiditis of a fulminating character. Operation immediately relieved the excruciating pain. Smear of the sero-sanguinous discharge showed *pneumo-streptococcus* in good number, and good phagocytosis. Temperature normal on fourth day. Discharged seventh day with slight drainage.

Case No. 764.—Patient was admitted complaining of pain in lower abdomen and in rectum. Onset sudden, three weeks ago, gradually subsiding, but recurring

Fig. 2.



Case No. 1085. (Mrs. E. T., age 34.) General peritonitis following septic abortion. Smear of pus evacuated through incision in posterior vaginal vault. Death 18 hours after admission. Note occurrence of streptococcus in pure culture, poor staining quality of majority of cells, and lack of adequate phagocytosis.

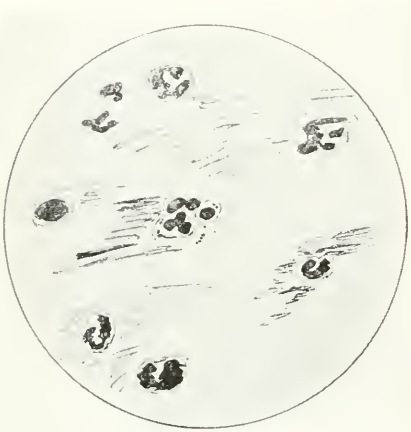
one week ago. Physical signs, negative, except for the collection of pus in pelvis. At operation a thick, yellow-green, non-odorous pus was evacuated. Staining revealed much detritus, and an occasional *Pneumococcus*, usually intracellular. After four days the temperature was normal. Discharged on eighth day with only slight drainage from vagina.

Case No. 1085.—Mrs. E. T., age 34, was admitted to the hospital complaining of abdominal pain, vomiting, and bloody discharge from uterus. Six days prior to admission she was seized with cramp-like pains in the lower abdomen. Then she began having bloody discharge from the vagina, passed clots, etc. Fever was present the following day, with nausea, vomiting, and abdominal distention;

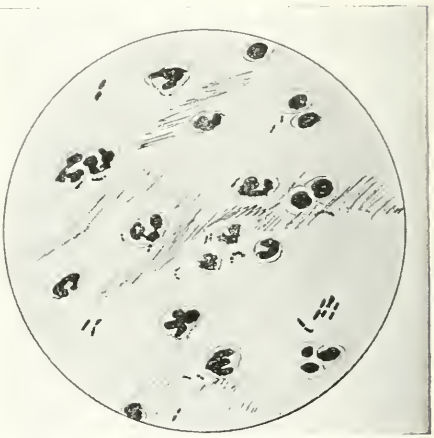
some looseness of bowels at onset, but constipation during the last forty-eight hours. Some frequency, but no other urinary symptoms. Says she has not missed a period. No respiratory symptoms except some difficulty in taking deep breath. The previous medical history, family history and social history are irrelevant.

The physical examination revealed a very toxic-appearing adult female. Face flushed, with anxious facies; lips parched; pupils moderately dilated; some cyanosis of lips and finger-tips; skin cold and moist in extremities, hot and dry over body; tongue, dry and coated; chest negative, except for rapid heart with poor quality sounds; abdomen distended and not affected by respirations; tenderness throughout, with muscular rigidity moderate; peristalsis absent.

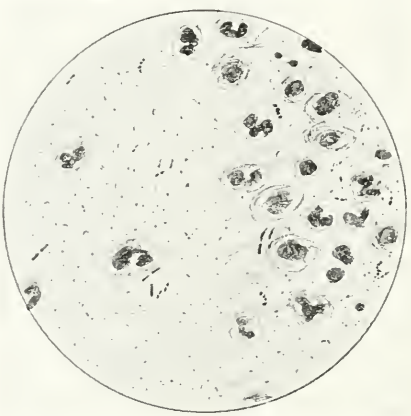
Fig. 3.



Smear of pus from tubal abscess, February 2, 1922.



Smear from wound, February 11, 1922.



Smear from wound, February 18, 1922.

Case No. 695. (Mrs. A. B., age 37.) Bilateral tubo-ovarian disease with abscess formation, and pelvic cellulitis.

In addition there were mild delirium and occasional emesis. Pelvic examination revealed a large boggy uterus, with tenderness on both sides, and a mass on the right side. The cervix was soft and dilated. There was a leucocytosis of 12,000.

Although the case was considered as moribund, it was decided a few hours after admission to do a posterior vaginal colpotomy. This was done without anæsthetic, and some dark, foul-smelling material was curetted from uterus. A quantity of thin, yellow, non-odorous pus was evacuated from the colpotomy. (See Fig. 2.)

Case No. 695.—Patient was admitted to hospital complaining of pain and soreness in lower half of abdomen. There was an indefinite history of an induced abortion several weeks prior to admission, followed by chills, fever, and the appearance of a mass in the left lower abdomen. Physical signs were as follows: Sallow-complexioned, toxic-looking, middle-aged French-Italian woman; anxious facies; head and neck surgically negative; lungs negative; heart rapid and sounds of poor quality, with no murmurs; abdomen moderately distended; flabby musculature; tenderness especially marked over lower half; mass size of a large grape-fruit palpable in left iliac fossa. On vaginal examination, a mass was easily palpable in left side of pelvis, and tenderness was marked on both sides. Extremities were negative.

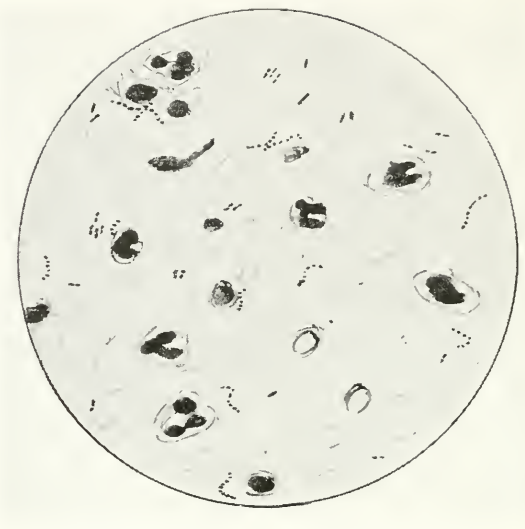
At operation, February 9, 1922, an abscessed left tube, including left ovary, was enucleated, and an abscess of right tube was also removed and a part of the right ovary. Drainage was placed, and the wound closed. Smears of the pus exposed at operation revealed an occasional short chain *Streptococcus*, usually intracellular, and an abundance of well-staining phagocytes. The temperature ranged from 101.6° F. to 103.4° F. for twelve days, and then rapidly came down to normal, the patient leaving the hospital on the twenty-second day.

It will be noted in the accompanying illustration that saprophytes had made their appearance two days after operation, and remained until the wound had practically healed. Although greatly outnumbered in the later smears, the *Streptococcus*, which was undoubtedly the underlying cause of this particular infection, was present up until healing was almost complete. It is in this type of case that the laboratory doing routine culture without control smear will invariably report back *B. Coli* or simply "Colon Group and Saprophytes" or some similar information. (Fig. 3.)

Case No. 690.—This patient was admitted complaining of a sore, swollen, right hand, and "streaks running up arm." Twenty-six months previous he had been shot in the hand with a 32-calibre bullet, and at the time an unsuccessful attempt had been made, by the physician who attended him, to remove the bullet. At intervals since then he had suffered with extreme pain and swelling of the hand, with fever and lymphangitis. X-rays showed the bullet to be at the base of the third metacarpal bone. General physical examination was negative.

After forty-eight hours' rest of the part, with the external application of heat and wet dressings, the foreign body was removed, an anterior and posterior incision being necessary to dislodge it. Thin pus was encountered in the neighborhood of the bullet. A smear revealed the presence of *Streptococcus* in short chains. Four days later, and even subsequently, the organism was present in large numbers in spite of the use of a hypochlorite solution. Yet the progress was good, and in two weeks the wound had practically healed. (Fig. 4.)

Fig. 4



Smear of pus at time of operation February 7, 1922.

Smear of pus four days later, February 11, 1922.

Case No. 690. (Mr. O. L. T., age 28, chauffeur.) Old foreign body (bullet), right hand, with superimposed infection. Operation, extraction of bullet and drainage, February 7, 1922.

Case No. 696.—Chief complaint on admission was pain and stiffness in region of lower spine, especially right side. There was an indefinite history of trauma three weeks previous, followed by constant backache, which at times had required hypodermics of morphine for relief. Had been hospitalized for one week in another hospital, and had been discharged in same condition as on admission. X-ray at that time had not revealed any pathology (patient's statement). Has had fever, but no chills. Had lost several pounds in weight. No G. U., respiratory, cardiovascular, or nervous symptoms were present. Previous history, negative except for miscarriage six years previous.

Physical examination revealed a very frail, anæmic, middle-aged woman in evident distress, and lying in bed with spine curved to the left, with no weight on right lower spine. Head, neck and chest surgically negative. Abdomen flat and rigid. Tenderness and feeling of mass in region of right kidney, lower pole. X-ray practically negative, suggestion of roughening of fifth right transverse (lumbar) process. A diagnosis of lumbar abscess was made.

At operation February 10, 1922, by Dr. J. G. Sheldon, an oblique incision was made from the right iliac crest downward and inward toward the sacro-iliac synchondrosis. After penetrating the lumbar fascia, a copious amount of thick, yellow-green pus was encountered. Smear showed very few organisms, mostly *Diplococci* without definite capsules, and a good phagocytosis. The presence of numerous polymorphonuclears was taken as evidence against tuberculosis. A smear the following day confirmed the first day's findings, and the organisms were morphologically *Pneumococci* or *Pneumo-streptococci*. (Fig. 5.)

The temperature dropped from 103° F. the day of operation down to normal in 48 hours, and remained there. She was out of bed and able to sit comfortably erect in a chair on the seventh day, and was dismissed with slight purulent drainage on the eighth day.

Case No. 686.—Patient admitted complaining of swelling, redness and pain in lower portion of abdomen. Had been confined nine weeks previous in a nearby town under home conditions. Had a very difficult labor, with death of infant. Stormy puerperium, gradually merging into above chain of symptoms, plus fever.

Previous history was negative except for usual childhood diseases, and three previous normal deliveries. The physical examination revealed a well-nourished, middle-aged woman in evident distress. Face flushed and general appearance of toxæmia. Head, neck and chest were surgically negative. Abdomen was flat except over pubes and in both inguinal regions, where there was a marked prominence, with reddening of the overlying skin, induration, and extreme tenderness on palpation. There was very slight œdema of the feet. A diagnosis of pelvic cellulitis was made.

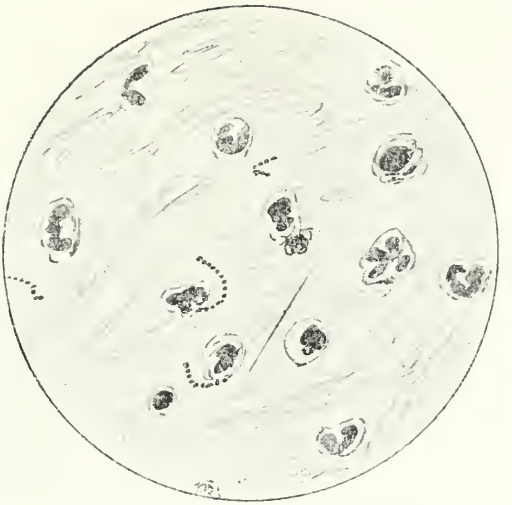
At operation, February 6, 1922, a median suprapubic incision was made, with an oblique left inguinal incision. Abundant thin, grayish pus was evacuated. Both incisions were enlarged bluntly, and the recesses of the suppurative area were explored with the index finger. Drains were inserted. As the accompanying illustrations will testify, there was no doubt as to the operative organisms. A prognosis of good recovery was made because of the good phagocytosis, and events confirmed it, for the temperature dropped from 103.4° F. on the day

Fig. 5.

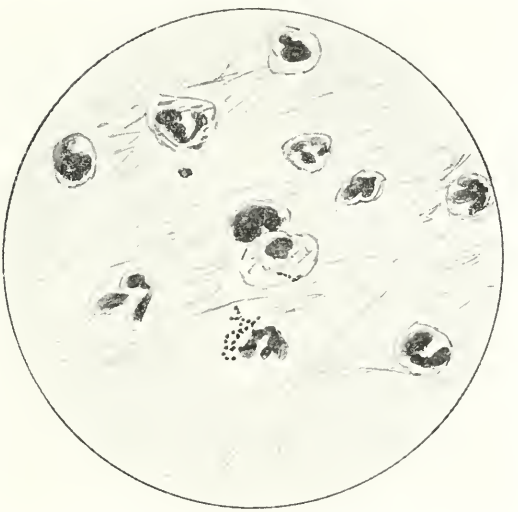
Smear of pus evacuated at operation February 10, 1922.

Smear of pus from depths of wound, February 11, 1922.
Case No. 696. (Mrs. M. L. D., age 38.) Right lumbar abscess.

Fig. 6.

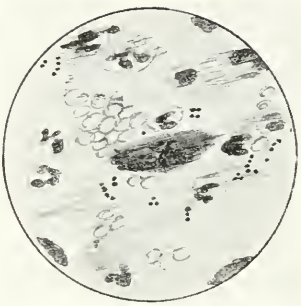


Smear of pus evacuated at operation February 6, 1922.

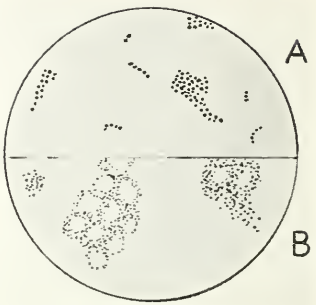


Wound smear five days later (Normal temperature 3 days).
Case No. 686. (Mrs. L. T., age 39.) Pelvic cellulitis.

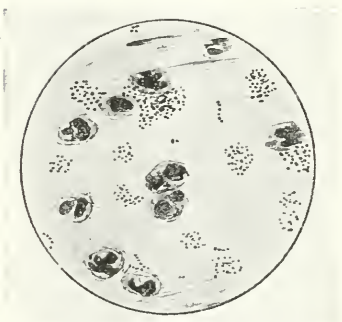
FIG. 7.



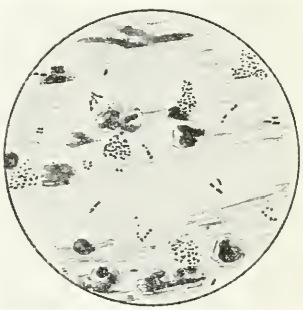
Smear of pus in medulla of right tibia, showing several short chain *Streptococci*, and isolated groups of cocci (*Staphylococci*). See culture.



A and B show organisms grown in 24 hours in bouillon and blood serum respectively, definitely a mixture of *Streptococcus* and *Staphylococcus aureus*.

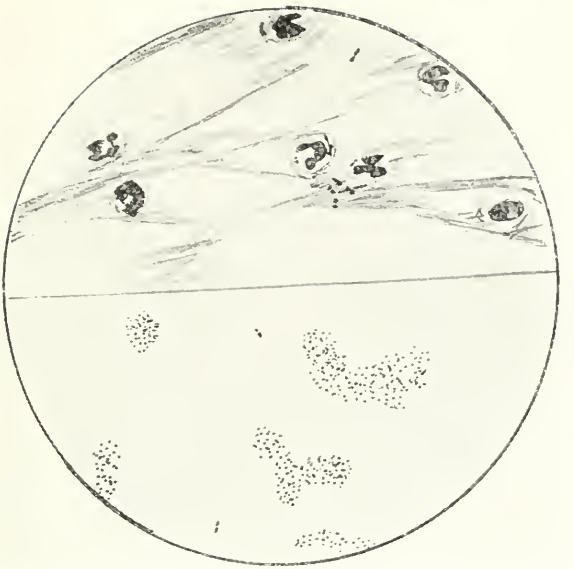


Wound smear two days after operation, confirming bacteriologic diagnosis of original smear, and showing more definitely the proportion of *Staphylococci* present.



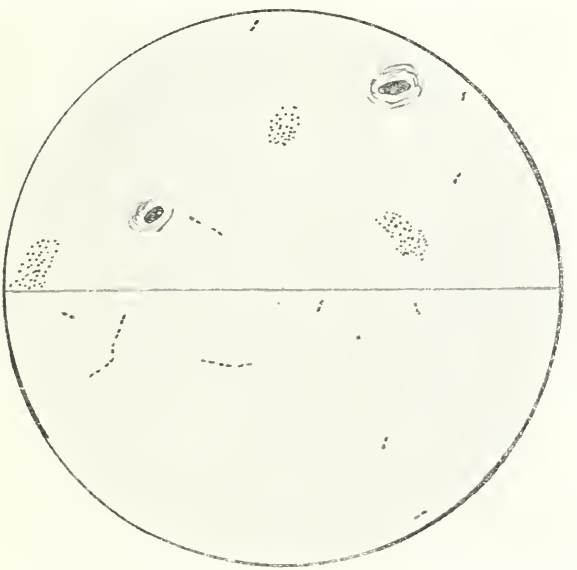
Wound smear five days after operation, showing the invasion of saprophytes. A general survey of a number of fields gives the impression of a decrease in number of *Streptococci*.

Fig. 8.



Smear of pus from kidney abscess.

Organisms grown in 24 hours on blood serum.



Stained urine sediment, three days after operation.

Urine sediment, ten days after operation.

Case No. 746. (Mr. A. R. G.) Cortical abscess of left kidney. Smears show progress of infection and change in flora. Daily smears were made of the discharges from the wound; recovery was complete

of operation, to normal on the third day. She was out in a chair on the sixth day, and went home in an ambulance on the seventh day. Has been well since. No wet dressings or antiseptic was used in this case, and sound surgery and good phagocytic power were responsible for the early recovery in spite of the virulent infection. (Fig. 6.)

Case No. 858 is of considerable interest as it represents a hematogenous infection of the medulla of the right tibia with *Streptococci* and *Staphylococci* in symbiosis, a rather common combination in infected war wounds.

The patient, a young Italian, who had served with combatant troops in the Italian army for four years, came complaining of constant pain in the right shin and leg of six months' standing. He had had two previous infected areas, which were treated while in the army—one in the left shoulder and one in the left hip, evidently an osteomyelitis. A sinus on the outer aspect of the left thigh is still draining intermittently. His general health was fairly good. The previous history was negative. There was no history of venereal disease, or of trauma.

The physical examination revealed the following data: Tall, fairly well-nourished, somewhat anæmic young man in some distress. Head surgically negative, except for a chronic naso-pharyngitis with buried infected tonsils. Neck and chest negative. Abdomen negative. Scar in left shoulder region, and sinus at upper outer aspect of left thigh. Extreme tenderness on palpation over the right tibia, swelling and redness over middle of shaft, and evident thickening of the shaft of the bone. X-ray showed considerable thickening, with shadow suggesting sequestrum.

At operation, the medullary cavity of the bone was exposed for about 10 cm. in the middle third, and a sequestrum removed. A teaspoonful of frank pus of a thin consistency was encountered, and a smear and culture made. Recovery was uneventful. At an early date it is contemplated to remove the tonsils (suspected foci). (Fig. 7.)

Are the tonsils actually the foci of infection in this case? If so, were they possibly the foci in a large number of secondarily infected war wounds?

Case No. 746.—On a diagnosis of abscess of left kidney, based on classical signs, the organ was exposed through the usual lumbar incision. There was considerable perirenal inflammatory tissue present. Near the upper pole there was an abscess the size of a lime. After careful examination the remainder of the kidney proved to be negative. The capsule was split from pole to pole and the abscess opened, explored and drained. The pararenal space was drained, and the wound closed to drainage.

As Fig. 8 shows, the infection proved to be a mixture of the *Pneumo-streptococcus* and *Staphylococcus aureus* (the latter based on culture). The drainage from the wound was free, but gradually subsided, and the patient was dismissed on the fourteenth day in excellent condition.

It will be noted that no *Staphylococci* were shown in the smear of pus taken direct from the abscess. That they were actually present, and not a contamination, is borne out by the finding of both groups of organisms in the urine before and after operation.

Although we cannot be as enthusiastic as is Wilkie in recommending the smear as a method of determining the prognosis in a given case, we have always been impressed with the fact that the *wound bacteriology was always more promptly, and usually more accurately, shown by the smear than by the usual routine cultural methods.*

As regards the bacteriology of intraäbdominal suppurative processes one has but to refer to the teaching of Murphy,[3] who, in speaking of appendicitis, said "....The smear has the advantage of giving immediate results and also of showing all varieties of bacteria that may be present..... The culture is inaccurate unless carefully plated, as the colon bacillus has the cultural peculiarity of overpowering other microörganisms during growth, and therefore a culture is an insufficient evidence of the bacterial flora of the appendix." Likewise: "In our experience the order, as concerns the flora of the appendix is the following: *Bacillus coli communis, Staphylococcus pyogenes aureus* and *albus, Streptococcus, Pneumococcus, Bacillus tuberculosis, Actinomyces.*"

As for the streptococcus—one of the most widely distributed of all the bacteria—certainly the finding of the organism in a pathologic process is more incriminating evidence of its pathogenicity than the fact that it is lethal for a laboratory animal or proves to be one of the hemolytic types after culture, immunological or agglutination reactions. Dochez[4] *et al* have shown that whereas it was conceded a few years ago that *Streptococcus hemolyticus* was a unit type, there are in reality at least six types. Furthermore this virulent organism has repeatedly been found in normal tissue and producing no symptoms. (Davis[5] and others.)

The work of Rosenow[6] re-asserts the existence of pleomorphic characteristics in the streptococcus-pneumococcus group, and in other groups. He has shown that the streptococci can no longer be classified according to their ability to ferment certain carbohydrates. On numerous occasions we have observed in ordinary smear what he has shown by carefully controlled experiments, namely, that mutations occur in the bacterial flora of wounds, not the result of superimposed infection.

In emphasizing the value of the smear, we realize that we are subject to the criticism of certain ultra-scientific pathologists and bac-

teriologists. It is commendable in them to search to the depths for truths in bacteriology. But when their findings show that many methods in vogue are of no avail, when by their work they have shown that no one knows when a streptococcus is or is not hemolytic, it is time for mere clinical workers to take account of stock and adopt a rational clinical bacteriology.

No one will deny that culture is frequently required, but such beliefs as those of Sweetser[7]—that culture of wound secretions "is certainly valuable, even if only for the purpose of determining the presence of streptococcus hemolyticus"—are no longer tenable. Given the report of the presence in smear, of streptococcus, we will say, and in addition, an index of the patient's resistance as shown by the number, character of, and staying qualities of the cells found in the smear, and the surgeon can ask little else of the laboratory. We would point out the necessity, often, of prolonged search of a film for bacteria, as prolonged as is frequently necessary to find the tubercle bacillus. If, at the end of such careful search, the organisms present cannot be diagnosed morphologically—or no organisms can be found—the usual notations should at least be kept of the degree of phagocytosis and the relative number of the various types of cells present, and cultures on the proper media made of the specimen-exudate.

In the last analysis, the well-trained surgeon has a pretty definite idea of the type of infection and the degree of individual resistance before he applies the knife, and what he did not know or had not anticipated he is trained to recognize as the gross pathology is revealed at operation. He is, or should be, ready to deal with the situation then and there regardless of the laboratory report, and even in spite of the laboratory report if need be. Therefore, the report from the bacteriologist, as a rule, simply confirms his suspicions, and the report is filed as part of the case record—probably never to be referred to again. If, on the other hand, the laboratory returns a report of the finding of some unlooked-for organisms in the stained smear, the bacteriologist goes on with his study by culture, inoculation, etc., while the surgeon deals with the situation on general surgical principles, and perhaps never has reason to inquire further as to the type of infection. If he is unusual, or if the patient does not get along as expected, he may request further data from the bacteriologist.

At any rate, and no matter where the hospital, the majority of laboratory reports based on culture are simply filed and are only of interest in the exceptional case. Quite in contrast is a system which we have followed for several years, of staining smears of wound secretions, and preserving, as one does tissue sections, those which are of interest.

By reason of this routine, and because we feel that this whole subject is still lacking in practical proof of the value of wound-smears, we have collected from a few months' work, a fairly representative collection of films. The illustrations presented are drawn, as accurately as possible, from the microscopic picture in each case. The fact that the organisms are rather difficult to find in several of the illustrations simply reflects the difficulty in finding them under the microscope, and emphasizes what we have already said—that one often has to search dozens of fields before finding an organism. From our experience we should say that in more than 90 per cent. of the cases where pus or exudate is present in a wound, a smear from that material, properly stained, will reveal the prevailing organism or organisms, if diligent search is made. Where organisms are scarce, at least one hundred fields should be examined. Before reporting "no organisms present," a like number of fields should also be examined.

A number of the cases reported show the wound flora together with the index of tissue reaction, that is to say, the staining qualities and proportion of the various phagocytes. Only one of the intra-abdominal infections in the present series happened to prove fatal, hence it is not possible to point out clearly, as did Wilkie, the earmarks of failing combative power on the part of the patient, as evidenced by poor phagocytosis, lack of macrophages and polymorphonuclears, poor staining qualities, large proportion of extra-cellular organisms, etc. The illustration, however, (Fig. 3.) shows well the type of infection and some of the qualities of a fatal infection as just enumerated.

In addition to the cases illustrated above, the following is a partial list of the smears from other sources made during the same period of time:

1. Pus and exudate from the urethra, prostate, and seminal vesicles after massage, etc., numerous cases.*

2. Urine sediments stained for *B. tuberculosis* and other organisms.

3. Conjunctival exudates, one case of Koch-Weeks bacillus infection having been positively diagnosed from the morphology in the stained smear, and later confirmed by culture.

4. Ear discharges.

5. Numerous nose and throat smears made at the time of inoculating culture media—several showing presence of *B. diphtheria* before growth on blood serum could confirm.

6. Sputa.

7. Gastric and duodenal contents aspirated through a Rehfuss tube.

8. Sediments from spinal fluid—in addition to cell-counts, culture, etc.

They represent a rather formidable bacteriologic display—for the diagnosis of the infecting organism and a measure of the success of the patient's fight against the particular organism is revealed in practically all.

CONCLUSIONS

1. We feel certain that a method of wound study such as has been outlined above, although in many respects not new, will appeal to many surgeons who have not adopted a similar routine, because of the economy of time and material, and the real value in diagnosis, prognosis and treatment.

2. Except in the rare instances where it is desired to prepare vaccines or serums, the mere bacteriologic diagnosis is all that is required. If this diagnosis can be made, as in most instances, by staining a film of the exudate, will it be more scientific and efficient to perfunctorily and routinely make cultures from the exudates and overlook the real picture of what is taking place in a given wound? We question very much whether it is of value to know, after the elaborate cultural procedures sometimes necessary, and in view of the findings of Dochez, Rosenow *et al*, whether it is the streptococcus

* In the case of "pus tubes" it is frequently possible to demonstrate the gonococcus. Culture in these cases is very often sterile.

hemolyticus or non-hemolyticus we are dealing with in a given case, providing we can obtain information as to the power of resistance of that particular individual for the invading strain of streptococci. Likewise, in the case of pneumococci, the typing might well give way to the smear (in view of recent developments). A reconsideration of many other laboratory methods would seem in order, as was shown by Stillman.[8]

3. In a number of cases of intraäbdominal suppuration, where culture alone was relied on to reveal the type of infection, the report was quite often *B. coli communis,* or "contamination." When this method was supplanted by preliminary smear of the pus, the true bacteriology of analogous cases was frequently found to be "streptococcus," and "streptococcus and G-negative bacillus," or "staphylococcus and B. coli," etc., plus the added information that phagocytosis was or was not good. In short, we are too well satisfied to accept a diagnosis of colon bacillus infection in the case of intra- and extra-abdominal suppuration, when this organism has simply outgrown or overgrown the real causative organism—often the streptococcus, sometimes the staphylococcus—usually two organisms in symbiosis, and so on by analogy in infections elsewhere.

4. We feel that in presenting this series of illustrated cases, we are helping to point the way for the average surgeon to obtain reliable data about the flora of wounds under treatment—data which most of us have felt could only be obtained after the most painstaking culture, sub-culture and inoculation.

5. The trituration, culture, and detailed study of any tissue, exudate, transudate or secretion will always be desirable where the simpler procedures fail to disclose the causative organisms.

REFERENCES

[1] D. P. D. Wilkie, M.Ch., F.R.C.S.: International Clinics, Vol. IV, 22nd Series, p. 145.
[2] E. P. Heller, M.D.: *Annals of Surgery*, lxxi, May, 1920, p. 663.
[3] J. B. Murphy, M.D.; "Keen's Surgery," Vol. iv, Chap. lxiii, p. 738.
[4] A. R. Dochez, M.D.; O. T. Avery, M.D., and R. C. Lancefield: *Jour. Exper. Med.*, Sept. 1, 1919, Vol. xxx, No. 3, pp. 179-213.
[5] D. J. Davis: *Jour. Infectious Dis.*, 1921, xxix, pp. 524.
[6] E. C. Rosenow, M.D.: *Jour. Infectious Dis.*, 1920, xxvi, pp. 469-491.
[7] T. H. Sweetser, M.D.: *Annals of Surgery*, lxxiii, Jan., 1921, No. 1, p. 4.
[8] R. G. Stillman, M.D.: *Jour. A. M. A.*, Jan. 25, 1921, Vol. 76, No. 26, p. 1816.

THE TREATMENT OF VARICOSE LEG ULCER

By WM. STEEL, M.D., B.S., F.A.C.S.
Philadelphia

With the exception of acute traumatic ulcerations, varicose ulcers of the leg are the most frequent external variety of body ulcer. Of its various names, varicose, congestive, stationary, indolent, callous or chronic leg ulcer, the term varicose is preferable as indicating the cause of the condition.

CHARACTERISTICS

It is an ulcer of middle and old age; more frequent in women than in men, and always preceded by superficial varicosities of the leg. It is usually solitary and of oval shape, and situated on the inner, lower half of the leg. The floor of the ulcer is sunken, smooth and shiny with scattered spots of grayish membrane and red points of feeble granulation. It never has the uniform, red, healthy, bleeding granulation base of a healing ulcer. The discharge is scanty, serous and in neglected cases offensive. There is little pain unless the ulcer exposes the periosteum of the tibial crest or malleoli. The edges are rounded, hard and elevated. This epithelial overgrowth at the edges is the only sign of healing which is shown. The leg is swollen and œdematous. The varicose veins are prominent on standing; and the surrounding skin is pigmented, indurated, and often eczematous. (Frontispiece, and Figs. 1 and 2.)

The cause of varicose ulcer is the superficial varicose veins which drench the subcutaneous tissues with stagnant venous blood and lymph, which results in a local undernourishment and underoxidation of the tissues. The whole saphenous system is functionless; a potential agent of infection, and may be viewed as a subcutaneous foreign body. The return circulation of the leg is maintained by the deep femoral and intramuscular veins.

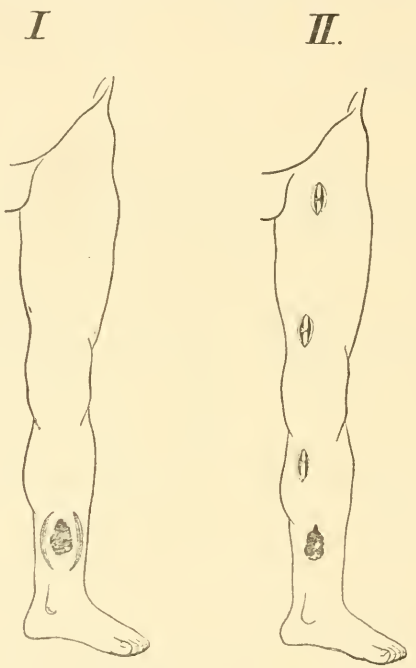
DIAGNOSIS

A syphilitic leg ulcer is the only chronic condition which might be confused with varicose ulcer. Syphilitic ulcers are multiple; most common on the upper, outer half of the leg; very painful; heal

at one point while spreading at another, and are associated with a history of syphilis and a positive Wassermann reaction.

TREATMENT

Successful management of varicose leg ulcer depends upon the treatment of the varicose veins which produce it. Control the veins and the ulcer heals itself. The indication in treatment is to obliterate



Circumcision of ulcer ligation. Multiple ligature of saphenous vein (Trendelenburg).

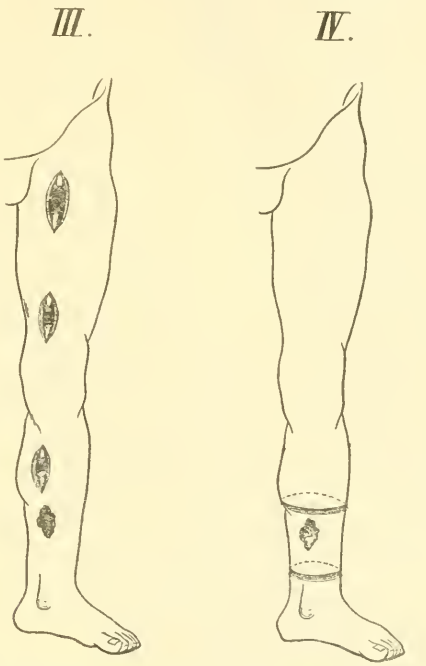
the large diseased subcutaneous trunks and the anastomotic branches which connect them with the healthy deep veins.

Palliative treatment is indicated in the aged and feeble; in those who have associated constitutional diseases such as diabetes, renal or cardiac conditions, hæmophilia; and in the robust who will not consent to operation. The principle underlying all palliative methods is temporarily to empty the varicose veins by gravity or by external pressure. It may be successfully applied by the following plan:

(1) For from one to two weeks keep the leg elevated; preferably

by confining the patient to bed. Hasten granulation formation by applying locally hot fomentations. When the surrounding skin has become healthy and the ulcer floor is covered with smooth red granulation tissue begin with the ambulatory treatment.

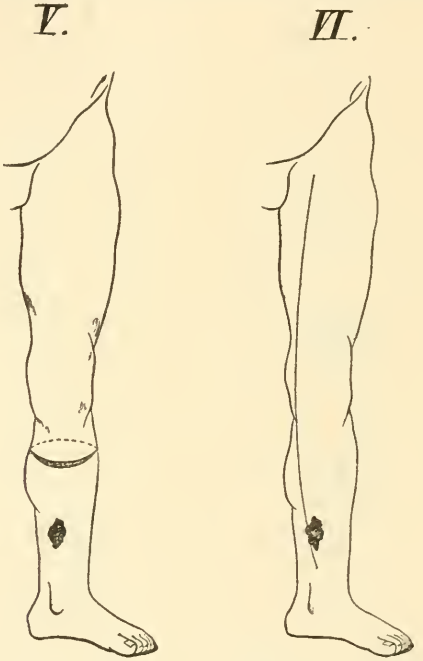
(2) The veins in a walking case must have constant support. Produce this by zinc oxide adhesive straps placed directly over the ulcer and a muslin spica bandage extending from the base of the toes



Multiple excisions of saphenous vein (Schwartz). Circumferential incisions (Moreschi).

to below the knee. (Figs. 3 and 4.) The straps are three-quarters of an inch in width and are applied in an imbricated manner from below upward. They extend two-thirds of the way around the leg and for two inches above and below the ulcer. Shave the skin and wash off with alcohol before applying. The dressing is changed every third day. If the skin irritates during the course of treatment, omit the traps for a few days and apply zinc ointment to the skin. The ulcer heals in from four to eight weeks.

(3) After healing occurs the patient wears an external leg support for the rest of his active life. The popular support is an elastic silk mesh rubber stocking. The most comfortable and satisfactory one is a type of the Murphy leg corset (Fig. 5.) This is made of washable silk or linen and is provided with stays to prevent sagging. It is laced on the side and has a stiff smooth tongue under the lacing. It extends to the ankle and is worn over a long stocking. The foot



Schede operation. Open extirpation of saphenous vein (Madelung).

is encased below it in a snugly fitting shoe. Any external support is removed at bedtime.

Operative Treatment.—This form of treatment is indicated in all cases not debarred through age or constitutional disease. Operation aims permanently to obliterate the main saphenous trunks and as many of their branches as possible. Cases relieved by external support respond best to operative methods.

The modern surgery of varicose veins of the leg dates from Trendelenburg's operation published in 1890. Circumcision of the

Fig. 1.

Varicose ulcer of 18 years standing, showing marked hypertrophic skin changes. Woman, aged 52 years, had suffered from varicose veins for twenty-five years.

Fig. 2.

Same foot and leg as in Fig. 1, three months after radical operation and resection of redundant skin folds. The ulcer is healed, but there is an excavation due to loss of tissues sloughed away while the ulcer was present.

Fig. 3.

Proper method of applying adhesive straps in the palliative treatment of varicose ulcer and in the ambulatory stage of operative cases.

FIG. 4

Proper method of applying spica bandage of foot and leg in the palliative treatment of varicose ulcer or in the ambulatory stage after operation.

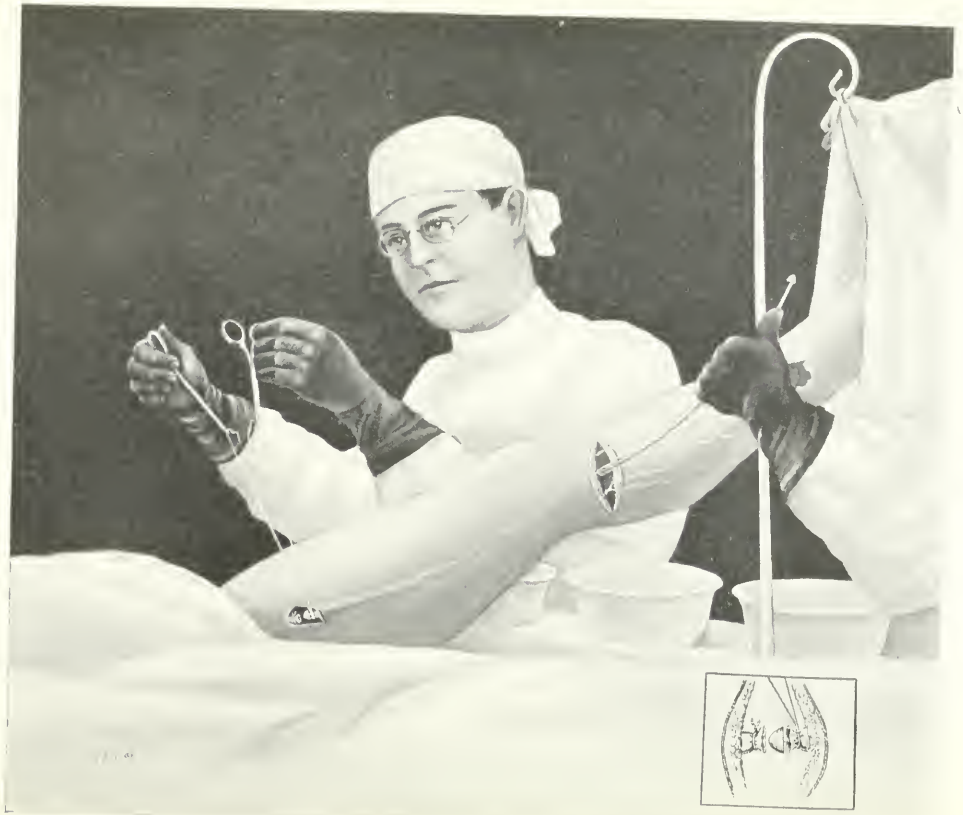
Fig. 5.

Murphy leg corset for the ambulatory treatment of varicose ulcer; made of washable linen or silk provided with light stays to prevent sagging, a tongue of stiff non-wrinkling material closes the gap between the laces put on over a lisle stocking and foot held by a snug shoe. Gutta percha paper is placed over the ulcer, and the stocking fitted over it.

Fig. 6.

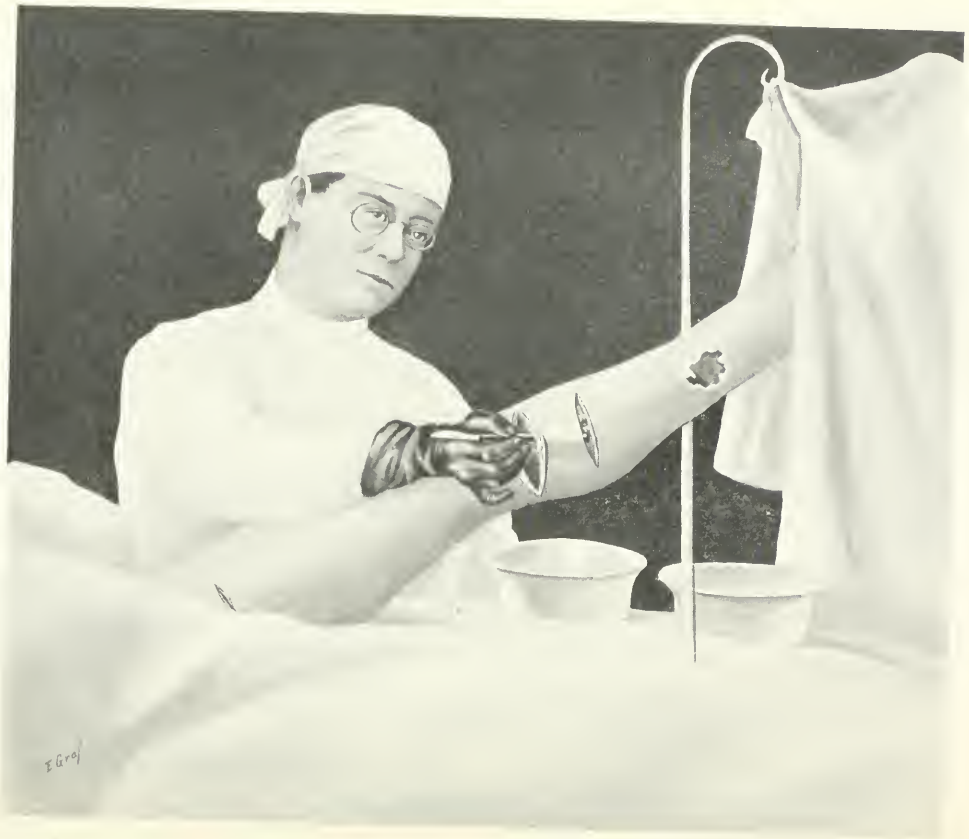
Radical treatment. The vein stripper is passed through the saphenous vein from a point just below the saphenous opening to a point two inches below the knee.

FIG. 7.



Radical treatment. The vein is tied to the large upper end of the probe and torn out in one piece, through the lower incision by a series of short, sharp jerks.

FIG. 8.



The internal saphenous trunk is removed. The Schede incision is continued around the leg below the knee. A second incision is made two inches below the Schede incision around the inner half of the leg, the skin undermined and all veins removed in the flap.

ulcer with ligation of the surrounding veins was an early surgical practice. Trendelenburg was the first to advocate obliteration of the main saphenous trunk by ligating the vein in the thigh and above and below the knee. Schwartz improved Trendelenburg's technic by excising segments of vein after ligating. Moreschi made circular incisions above and below the ulcer, undermined the skin and removed all veins in the pedicled flap. Schede made a circular incision below the knee, ligating all veins encountered. Madelung removed the entire internal and external saphenous trunks by long open incisions. Rindfleisch made a continuous spiral incision around the leg from the knee to the ankle. The Mayos were the first to perfect subcutaneous removal of the saphenous vein by their vein stripper. Threading it over the vein by an incision in the upper part of the thigh and working it loose through multiple incisions. Babcock simplified the subcutaneous method, by devising a stripper which works from within instead of from without the vein, and removes it entirely through two incisions. The various forms of operation are seen in the text figures, I to VIII. A combination operation employing the Babcock probe to remove the internal saphenous trunk has in our hands given satisfactory results.

TECHNIC

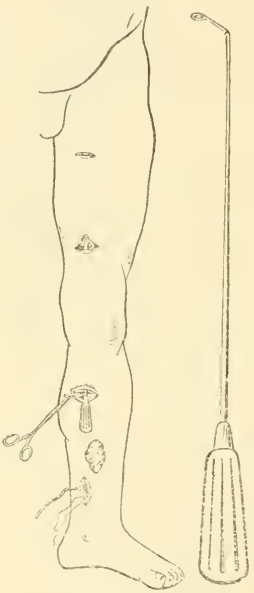
The patient is confined to bed for one week or until the ulcer takes on a healthy appearance. The leg is prepared for operation and elevated on a gynecological standard to lessen bleeding. A one-inch transverse incision is made over the saphenous vein in the upper third of the thigh. The vein is isolated, and opened transversely and the small end of the vein stripper introduced into its lumen, and worked down the vein to a point two inches below the knee. At this point the skin is incised transversely and the vein and its contained probe exposed. The small end of the probe is then pushed through the vein wall and pulled out until the upper large end of the instrument engages the upper opening in the vein. The vein is tied to the upper end of the stipper with stout silk, ligated one inch above this point with catgut, and divided between the two ligatures. The lower free end of the stripper is firmly grasped and by a series of short, sharp jerks the vein is torn loose from its collateral branches and subcutaneous attachments and delivered in one piece

through the lower opening. The excised vein is not everted, but is pleated up as a mass in the cup-shaped cavity at the large end of the stripper. There is but slight bleeding from the torn collaterals in the thigh. (Figs. 6, 7, and 8.)

The incision below the knee is continued around the leg, as in the Schede operation. All divided veins are ligated. A skin area one

VII. VIII.

Spiral incision of leg (Rindfleisch).



Mayo vein stripper.

inch long is left undivided at the upper and lower pole of the circular incision. A second incision is now made around the inner half of the leg two inches below the Schede incision. The skin flap dissected up and all underlying veins removed. This permanently blocks the diseased saphenous system on the inner half of the leg.

The incisions are sutured with silk-worm gut, and a snug spica bandage is applied over the dressings from the toes to above the knee. The ulcer heals rapidly usually without skin grafts. The patient is out of bed on the tenth day and walks on the fourteenth. A sup-

porting bandage is worn during the day for two months after operation and all external support then discarded.

In six per cent. of our cases a tortuous, adherent vein, obstructed the passage of the probe and made a complete avulsion of the saphenous by this means impossible. In such cases open excision or multiple ligation must be done. The secondary operation below the knee can always be accomplished.

STATISTICS

Fifty cases operated upon by the above method have resulted as follows:

42....84 per cent.....cures

6....12 per cent.....improved. They wear intermittently some type of external support.

2.... 4 per cent.....failures. The ulcers recurred and were persistent.

In the two failures the ulcers extended over the malleoli, and were of the anæmic, neurologic variety. Experience has shown that this type of ulcer is unfit for any operation except a pedicled flap graft. In one of them leg amputation was later requested and performed.

The advantages claimed for the method are:

(1) It practically extirpates the diseased saphenous system.

(2) It is a comparatively rapid procedure.

(3) Good post-operative results are obtained.

(4) It is one of the most satisfactory operations from the standpoint of the patient which we perform.

ATTACHMENT FOR THE THOMAS SPLINT TO KEEP THE FOOT AT RIGHT ANGLES AND ALLOW ANKLE MOVEMENT

By GEORGE G. DAVIS, M.D.

Chief Surgeon to the Illinois Steel Company, Chicago

Since the war the Thomas splint has been used extensively in fractures of the leg and thigh. The splint has been used equally as a temporary dressing and as a permanent splint in the treatment of fractures. With the use of this splint, surgeons have recognized the need of keeping the foot at right angles to prevent "foot drop." In temporary splinting, to overcome this "foot drop" and to keep the foot at right angles, instrument makers have made suitable attachments for the Thomas splint (Fig. 1) which holds the foot in place and also elevates the splint off the bed or stretcher. The same attachment has at times been employed in the permanent splinting of fractures to keep the foot at right angles and it does accomplish this admirably. The objection to this, however, is that the ankle joint becomes stiff in this position.

To overcome the complication of a stiff ankle it has been the surgical practice by means of a Balkan frame, weight, pulley and cord, attached to adhesive applied over the sole of the foot from back of the heel to the ball of foot, to keep the foot at right angles and allow motion at the same time. However, this more complicated method at times is inconvenient as one or another of the various parts of this appliance may be a bit difficult or inconvenient to obtain.

The writer conveniently accomplishes all of these features in a slight modification of the usual foot attachments designed for the Thomas splint (Fig. 2). This modification is simply the addition of a grooved wheel to the uppermost portion of the foot attachment.

With this the foot can be immobilized in the right angle position either as a temporary or permanent dressing. Or the appliance may be used to keep the foot at right angles and at the same time allow ankle motion (Fig. 3) by the use of a weight and cord going over the grooved wheel, with the cord attached to adhesive, applied to the sole of the foot from in back of the heel to the ball of foot.

Fig. 1.

Attachment for Thomas splint designed to keep the foot at right angles.

FIG. 2.

Pulley wheel modification of Thomas splint foot attachment designed to keep foot at right angles and allow movement of the ankle joint. The weight over pulley holds foot at right angles but allows ankle movement.

Fig. 3.

Showing the patient extending the foot and overcoming the weight which will bring the foot again to right angles.

INDEX TO VOLUME IV

(THIRTY-SECOND SERIES)

A

Abscess of liver, metastatic, 234
varieties of, 236
Acidosis, French and American conceptions of, 89
Albumin milk in nutritional disorders, 96
Amaurotic family idiocy, 225
Angioma, 244
Antenatal clinic of the Edinburgh Royal Maternity Hospital, 9
Arny, H. V.: Pharmaceutical research, 203

B

Ballantyne, J. W.: The antenatal and V. D. clinics at the Edinburgh Royal Maternity Hospital, 9
Bith, Henry: The French and the American conceptions of acidosis, 89
Bowers, Paul E.: Crime and insanity, 44

C

Cahill, James A., Jr.: Metastatic abscess of the liver, 234
Calculi, renal, 246
Carbon dioxide snow, treatment of angioma by, 244
Cardiovascular syphilis, 131
Clinical medicine, department of, 108
surgery, department of, 246
Clough, Harry D.: A study of seven cases that present diastolic heart murmurs, 176
Coué's method, 207
Crime and insanity, 44

D

Davis, George G.: Attachment for Thomas splint, 302
Deficiency diseases, 69
De Sanctis, A. G.: Amaurotic family idiocy with symptoms simulating tetany, 225
Diachylon compound causing lead poisoning, 232
Diastolic heart murmurs, 176
Diets, faulty, diseases resulting from, 69
Diphtheria, bacillus carriers, 157
epidemics of, 173
prophylaxis of, 166
susceptibility to, 160
Diseases, deficiency, 69
gall-bladder, 108
resulting from faulty diets, 69

E

Edelman, Moses Henry: Persistent jaundice with unknown etiology, 228
Edinburgh Royal Maternity Hospital, antenatal and V. D. clinics at, 9
Eisendrath, Daniel N.: Stone in the kidney, 246
Encephalitis and lead poisoning, 231
Epidemics of diphtheria, 173
Eyesight of school children, guarding the, 31

F

Faulty diets, diseases resulting from, 69
Flynn, James M.: A study of seven cases that present diastolic heart murmurs, 176
Foote, John A.: What a social worker should know about medicine, 40
Franz Shepherd Ivory: Mental traumata, and the preparation of the medical profession to care for them, 1

G

Gall-bladder diseases, 108
Goitre, endemic, iodine treatment of, 76
Goldberger, Joseph: A consideration of deficiency diseases: diseases resulting from faulty diets, 69

H

Hall, Milton W.: Some general considerations regarding the etiology of the respiratory infections, 123
Heart murmurs, diastolic, 176
Heller, Edward P.: Usefulness of wound smears to the surgeon, 281
Hitchens, A. Parker: Diphtheria: epidemiology; individual susceptibility and prophylaxis, with special reference to the Schick test; treatment and management of epidemics, 151
Hyperglycæmia, 223

I

Infections, respiratory, etiology of, 123
Insanity and crime, 44
Iodine treatment of endemic goitre on a large scale, 76

J

Jaundice, catarrhal, 230
  hemolytic types of, 230
  infectious, 230
  persistent, 228

K

Kidney, stone in the, 246

L

Labbé, Marcel: The French and the American conceptions of acidosis, 89
Lead poisoning with encephalitis, 231
Leg ulcer, varicose, treatment of, 295
Liver, metastatic abscess of, 234

M

McLean, Stafford: Augioma, 244
Mead, Sterling V.: The diagnosing of oral sepsis by röntgenograms, 257
Medical profession, preparing it to care for cases of mental traumata, 1
  welfare work, department of, 1
Mental traumata, 1
Milk, albumin, in nutritional disorders, 96
Murmurs, heart, diastolic, 176

N

Norton, N. R.: Chronic lead poisoning with encephalitis, 231
Nutritional disorders, albumin milk in, 96
  problems, department of, 69

O

Oral sepsis, 257

P

Pædiatrics, department of, 223
Pardee, Irving: Polyglandular deficiency with hyperglycæmia, 223
Pharmaceutical research, 203
Polyglandular deficiency, 223
Psychoneuroses, therapeutics of, 207

R

Radium, treatment of angioma by, 244
Renal calculi, 246
Research, pharmaceutical, 203
Respiratory infections, etiology of, 123
Robertson, William Egbert: Some comments concerning vitamins, 78
Rolleston, Humphry: Some points in the diagnosis, prognosis and medical treatment of gall-bladder diseases, 108
Röntgenograms in diagnosing oral sepsis, 257

S

Schick test, 151
School children, guarding the eyesight of, 31
Sepsis, oral, 257
Shell shock, 218
Smears, wound, 281
Smukler, M. P.: Guarding the eyesight of school children, 31
Social workers, what they should know about medicine, 40
Steel, Wm.: The treatment of varicose leg ulcer, 295
Stone in the kidney, 246
Strauch, August: Albumin milk in nutritional disorders of artificially fed children, 96
Swan, John M.: A study of seven cases 176
Syphilis, cardiovascular, 131

T

Tetany, chronic, 225
Thom, Burton Peter: Cardiovascular syphilis, 131
Thomas splint, attachment for, 302
Traumata, mental, 1

U

Ulcer, varicose leg, treatment of, 295

V

Varicose leg ulcer, treatment of, 295
V. D. clinic of the Edinburgh Royal Maternity Hospital, 9
Vitamin A, 70, 78
  B, 70, 78
  C, 70, 78
  D, 70, 78
Vitamins, comments concerning, 78
Voegelin, Samuel: Usefulness of wound smears to the surgeon, 281

W

Walsh, James: The therapeutics of the psychoneuroses, 207
Wound smears, 281

GENERAL INDEX

(THIRTY-SECOND SERIES)

(The Roman numerals refer to volumes of the thirty-second series, i for March; ii for June; iii for September; iv for December.)

A

Abdominal lymphosarcoma, i, 136
Abrasion, iii, 46
Abscess, amœbic, of liver, i, 221
  of liver, metastatic, iv, 234
    varieties of, iv, 236
  of mediastinum, ii, 139
  pelvic, i, 266
Achylia gastrica in old age, iii, 256
Acidosis, French and American conceptions of, iv, 89
Addison's disease, pigmentation resembling, in brain tumor, ii, 93
Adenoma and hyperthyroidism, i, 182
Albumin and casts in urine, importance of, i, 198
  milk, in nutritional disorders, iv, 96
Albuminuria, i, 198
Alcoholic injections in malignancy for relief of pain, iii, 287
Alkalies in diabetes, i, 179
Allen, treatment of diabetes, i, 178
Alveolitis, iii, 11, 12
Amaurotic family idiocy, iv, 225
Amblykusis, iii, 145
Amblymusia, iii, 148
Amentia, iii, 121
Amœbic abscess of liver, i, 221
Amusia, iii, 148
Anæmia, blood transfusion in, i, 274
  pernicious, i, 8, 186, 272
    diagnosis of, i, 187
    etiology of, i, 186
    gastrointestinal symptoms in, i, 11
    splenectomy of, i, 188
    symptoms of, i, 187
    treatment of, i, 188
  simulating pernicious anæmia, i, 89
  spleen in, i, 268
  splenic, i, 193, 270
Analgesia synergistic, i, 287
Anaphylactic shock, iii, 103
    due to proteins, i, 64
Anatomy of mediastinum, ii, 127
Aneurysm of aorta, ii, 139
Angioma, iv, 244
Angio-sarcoma of shoulder, i, 123
Antenatal clinic of the Edinburgh Royal Maternity Hospital, iv, 9
Antianaphylaxis, iii, 105
Anticytost, iii, 83, 106
Anti-rachitic principle, iii, 209
Aorta, aneurysm of, ii, 139
Aortic insufficiency, i, 93, 94
Appendicitis, i, 267
Appendix, mucocele of, ii, 303
Arny, H. V., iv, 203
Arrhythmias in young women, i, 99
Arterio-sclerosis in gastric disturbances of old age, iii, 249
  visceral, in old age, iii, 270
Arthritis, i, 238
  etiology of, i, 238
  gonococcus, i, 239
  treatment of, i, 239
Ascites, chylous, ii, 245
    in infants, ii, 244
Asphyxia, traumatic, ii, 10
Asthma, i, 60
  complication of, i, 61
  extrinsic, i, 61
Athethosis, acquired bilateral, i, 84
Auricular fibrillation, i, 28, 195; ii, 1
    quinidin for, i, 195, 197
  flutter, ii, 1
Autolysis, systemic, iii, 100

B

Backward children, iii, 118, 142
Ballantyne, J. W., iv, 9
Banti's disease, i, 194
Bassoe, Peter, iii, 220
Beck, Emil G., i, 122
Bevan, Arthur Dean, i, 118
Bile, organisms in, iii, 239
Biliary drainage, i, 219, 259
  lesions, i, 259
  tract and typhoid infection, iii, 239
Bishop, Louis Faugeres, i, 15
Bith, Henry, iv, 89
Blood transfusion in anæmia, i, 274
Blood-vessel transplantation, iii, 68
Bone disease, i, 246
  transplantation of, iii, 58

Bowers, Paul E., ii, 114; iv, 44
Brain, gliomatous cyst of, ii, 251
tumor, ii, 251
of fourth ventricle of, ii, 93
Bram, Israel, ii, 108
Bransfield, J. Wm., iii, 287
Breast, cancer of, i, 126, 276
fed infants, stools of new-born, i, 114
tumors of, i, 276
Bronchial gland, tuberculosis of, ii, 102
infections and rickets, ii, 239
resistance, ii, 242
Broncho-pneumonic tendency, ii, 242
Burnet, James, iii, 209

C

Cahill James A., Jr., iv, 234
Calcaneum, osteomyelitis of, i, 152
Calculi, renal, iv, 246
Cancer of breast, i, 126, 127, 276
of lip, i, 124, 247
of lymph-nodes, ii, 138
of neck, i, 124
of plants, iii, 164
of prostate, i, 291
of rectum, ii, 267
of stomach, i, 214
in old age, iii, 259
of tongue, i, 249
propaganda, i, 249
recurrent, i, 125, 127
reduction of, death-rate in, iii, 163
surgery and radium in apparently hopeless cases of, i, 122
surgical aspects of, i, 118
Cancerous adenopathies, ii, 138
Carbon dioxide gas injected into peritoneal cavity, ii, 45
snow, treatment of angioma by, iv, 244
Carcinoma—see cancer
Cardiologic experiment in treatment of heart disease, i, 15
Cardiovascular syphilis, iv, 131
Caries, iii, 48
Carrel-Dakin treatment in chest surgery, iii, 278, 280, 281
Carrel's method of transplantation, iii, 54
Cartilage, transplantation of, iii, 59
Catarrhal phenomena in rickets, iii, 214
Chest surgery, some newer aspects of, iii, 275
Childhood, nephritis in, i, 202
occult disease of, i, 101
Children, backward, iii, 118
development of normal, iii, 132
feeble-minded, iii, 118
nervous, unruly, iii, 150
osteomalacia in, ii, 187
prolapse of rectum in, i, 149
splenic anæmia in, i, 271
umbilical hernia in, ii, 7
Cholecystitis, i, 261
Chorea, i, 236
Christian, Henry A., i, 8
Christopher, Frederick, i, 129, 136
Chylous effusion, ii, 245
Circulatory abnormalities in young women, i, 86
Cirrhosis of liver, i, 222
in Wilson's disease, i, 73
Civil surgery, gas gangrene in, i, 129
Clavicle, dislocation of, ii, 10
Cleft palate, ii, 258
complete, ii, 263, 264
single, ii, 261
Clinical medicine, department of, iv, 108
surgery, department of, iv, 246
Clough, Harry D., iv, 176
Colitis, ii, 26
Colon, excision of, ii, 26
Complement fixation in hydatid disease, ii, 84
Comprachicos, iii, 118
Congenital syphilis, ii, 230
word-deafness, iii, 145
Cord, transverse lesions of, iii, 220
Cornea, transplantation of, iii, 64
Coué's method, iv, 207
Cranial decompression, iii, 156
Cretin type of feeble-minded children, iii, 135, 138
Crime and insanity, iv, 44
Criminal insane, ii, 115
Cultivation of medicinal plants, iii, 165
Cumston, Charles Greene, i, 160
Cysts, hydatid, of lung, ii, 47
of brain, gliomatous, ii, 251
Cytost, iii, 83, 106

D

Davis, George G., i, 142; iv, 302
Warren B., ii, 258
Davison, Charles, ii, 10
Marshall, ii, 303
Death-rate in cancer, reduction of, iii, 163
Decompression, cranial, iii, 156
Deficiency diseases, iv, 69
Degeneracy, stigmata of, iii, 134
Delessert, E., ii, 127
Dermoid cyst of mediastinum, ii, 140
De Sanctis, A. G., iv, 225
Development of normal child, iii, 132
Diabetes, i, 176
alkalies in, i, 179
Allen treatment of, i, 178
fat diet in, i, 177
hyperthyroidism and, i, 179
infections and, i, 176
obesity and, i, 176
Diachylon compound causing lead poisoning, iv, 232

Diastolic heart murmurs, iv, 176
Diet, protein, in nephritis, i, 203
Diets, faulty, diseases resulting from, iv, 69
Dilatation of the stomach in old age, iii, 261
Diphtheria, bacillus carriers, iv, 157
  epidemics of, iv, 173
  prophylaxis of, iv, 166
  susceptibility to, iv, 160
  toxin contrasted with shock toxin, iii, 87
Diseases, deficiency, iv, 69
  gall-bladder, iv, 108
  resulting from faulty diets, iv, 69
  with increased movements, i, 67
Disturbances, gastric, of old age, iii, 245
Diuretic, potassium chloride as a, i, 203
Dorrance, Geo. M., iii, 287
Dried milk, dangers from use of, in feeding babies, iii, 210
Drueck, Charles J., i, 144; ii, 294
Duodenal ulcer, i, 208, 212, 216, 250
Duodenum, ulcer of, in old age, iii, 257
Dust, relation of, to tuberculosis, i, 230
Dystonia, musculorum deformans, i, 82
Dystonias, i, 67

E

Ectopic gestation, ii, 17
Ectropion, ii, 294, 295
Eczema i, 63
Edelman, Moses Henry, iv, 228
Edinburgh Royal Maternity Hospital, antenatal and V. D. clinics at, iv, 9
Effort syndrome in young women, i, 97
Eisendrath, Daniel N., iv, 246
Encephalitis, acute hemorrhagic, i, 24
  and lead poisoning, iv, 231
  epidemic and Parkinsonian syndrome, i, 79
  lethargic, i, 29
Eosinophilia in hydatid disease, ii, 84
Epidemics of diphtheria, iv, 173
Epidermic graft in plastic eye surgery, iii, 292
Epithelial neoplasms of testicle, i, 168
Erosion, iii, 50
Erythema nodosum, i, 237
Essential oil industry, iii, 197
Exenteration of the orbit, iii, 293
Eye surgery, epidermic graft in plastic, iii, 292
Eyesight of school children, guarding the iv, 31

F

Fallopian tubes, streptococcus infection of, iii, 38
  tuberculosis of, iii, 36
Fascia, transplantation of, iii, 60
Fat diet for diabetes, i, 177
  transplantation of, iii, 61
Fatigue, iii, 73
  toxin, iii, 77
Faulty diets, diseases resulting from, iv, 69
Feeble minded children, iii, 118
    definition of, iii, 121
Feeding in rickets, iii, 209
Female, genitals, gonococcus infection of, ii, 38
Figure-blindness, iii, 145
Flynn, James M., iv, 176
Focal infection, iii, 5
  infections and goitre, ii, 110
Foote, John, ii, 239; iv, 40
Fractures, i, 241
Franz, Shepherd Ivory, iv, 1
Frazier, Charles H., ii, 251
Friedenwald, Julius, iii, 245
Funiculitis, vertebral, iii, 232

G

Gall-bladder, i, 259
  diseases, iv, 108
Gangrene, gas, in civil surgery, i, 129
Gas gangrene, i, 129
Gassing, effect on lungs, i, 231
Gastric affections, nervous, in old age, iii, 269
  analysis, i, 205
  contents, i, 205
  disturbances of old age, iii, 245
  ulcer, i, 207, 250
    Sippy treatment of, i, 212
    syphilis and, i, 208
Gastritis, acute, in old age, iii, 256
  chronic, in old age, iii, 256
Gastrointestinal disturbance in anæmia, i, 11
Gastroptoses in old age, iii, 262
Gilomatous cyst of brain, ii, 251
Gittings, J. Claxton, i, 101
Glycosuria in goitre, i, 182
Goitre, etiology of, i, 181; ii, 110
  focal infections and, ii, 110
  glycosuria in, i, 182
  heredity in, ii, 110
  infectious diseases and, ii, 110
  iodine in treatment of, ii, 109; iv, 76
  ovarian and uterine conditions and, ii, 110
  prevalence of, i, 180
  prevention of, ii, 111
  prophylaxis of, i, 183
  retro-sternal, ii, 140
  substernal, i, 182, 283
  surgical treatment of, i, 281
  treatment of, i, 184
Goldberger, Joseph, iv, 69
Gonococcus infection of female genitals, ii, 38

Goodman, Charles, iii, 54
Grant, Francis C., ii, 251
Graft, epidermic, in plastic eye surgery, iii, 292
Groin, sarcoma of, i, 126

H

Hall Milton W., iv, 123
Hammer, A. Wiese, iii, 239
Harelip, ii, 258, 264
  bilateral, ii, 263
  median, ii, 259
  single, ii, 261
  unilateral, ii, 260
Hawes, John B., 2nd, ii, 102
Hay fever, i, 58
Heart in rheumatic fever, i, 1
  disease, i, 15, 28
    cardiologic and sociologic experiment in treatment of, i, 15
  lesions in young women, i, 86
    relationship of, to thyroid enlargement, i, 96
    types of, in young women, i, 91, 94
  murmurs, diastolic, iv, 176
    functional, i, 95
Heel, sarcoma of, i, 126
Heller, Edward P., iv, 281
Hemoclasis, i, 223
Hemoptysis in hydatid cyst of lungs, ii, 78
Heredity and goitre, ii, 110
Hernia, inguinal, bilateral direct, ii, 29
    recurrent, ii, 33
  umbilical, ii, 7
Heteromorphisms, regional vertebral, iii, 236
Hitchens, A. Parker, iv, 151
Hodgkin's disease, i, 36
Hour-glass stomach, i, 255
Hydatid cyst, etiology of, ii, 63
    frequency of, ii, 63
    in Algeria, ii, 63
    of lung, pathology of, ii, 71
    of mediastinum, ii, 140
  cysts of lung, ii, 47
    clinical aspects of, ii, 77
    complement fixation in, ii, 84
    death of, ii, 76
    eosinophilia in, ii, 84
    hemoptysis in, ii, 78
    medical treatment of, ii, 89
    objective diagnosis of, ii, 83
    puncture of, ii, 89
    radiography in, ii, 85
    rupture of, ii, 76
    sputum in, ii, 83
    suppuration of, ii, 76
    surgical treatment of, ii, 90
    symptoms of, ii, 48
    thoracotomy for, ii, 90
  disease, mode of infection, ii, 66
    circulatory route, ii, 69
    digestive route, ii, 69
    hepatic route, ii, 70
    lymphatic route, ii, 70
    respiratory route, ii, 70
Hyperglycæmia, iv, 223
Hyperthyroidism, i, 282
  and adenoma, i, 182
  and diabetes, i, 179
  and nephritis, i, 200
  in goitre, i, 184
  myocardial necrosis in, i, 183
  physiological, i, 180
Hypospadias, i, 15

I

Idioglossia, iii, 146
Idiot, definition of, iii, 121
Imbecile, definition of, iii, 121
Industrial medical examinations, i, 86
Infantile umbilical hernia, ii, 7
Infants, ascites in, ii, 244
  stools of new-born, breast-fed, i, 114
Infections and diabetes, i, 176
  focal, iii, 5
  pelvic, ii, 36
  respiratory, etiology of, iv, 123
Infectious diseases and goitre, ii, 110
Influenza, i, 79
Injections, alcoholic, in malignancy for relief of pain, iii, 287
Inguinal hernia, bilateral, ii, 29
    recurrent, ii, 33
Insane, criminal, ii, 115
  dangerous, ii, 114
Insanity and crime, iv, 44
Intestinal obstruction, i, 257
Iodine in treatment of goitre, ii, 109; iv, 76
  for thyroid disease, i, 280

J

Jaundice, catarrhal, iv, 230
  hemolytic types of, iv, 230
  infectious, iv, 230
  persistent, iv, 228

K

Kelley, Thomas A., ii, 17
Kidneys, decapsulation of, i, 203
  diseases of, i, 198
  polycystic, i, 199
  stone in the, iv, 246
  transplantation of, iii, 62
Kraemer, Henry, iii, 135

L

Labbé, Marcel, iv, 89
Lavillat, Francis, ii, 47
Lead poisoning with encephalitis, iv, 231

Leg ulcer, varicose, treatment of, iv, 295
Lenticular degeneration, i, 67, 70
paralysis agitans and, i, 76
pathology of, i, 73
symptoms of, i, 71
Lesions of spine producing nervous syndromes, iii, 220
Lethargic encephalitis, i, 29
Leukæmia, i, 190
acute, i, 190
chronic lymphatic, i, 191
polyneuritis in, i, 191
treatment of, i, 192
Lip, cancer of, i, 124, 247
Lipoids in urine, i, 199
Liver, amœbic abscess of, i, 221 ; iv, 231
cirrhosis of, in Wilson's disease, i, 73
portal, i, 222
disturbances of, i, 220
insufficiency, i, 223
metastatic abscess of, iv, 234
Lockwood, Charles D., iii, 275
Lung, hydatid cysts of, ii, 47
rupture of, ii, 10
Lymphadenoma of testicle, i, 165
Lymphatic leukæmia, i, 191
Lymphosarcoma, abdominal, i, 136
classification of, i, 136, 137

M

McCrae, Thomas, i, 1
McCready, E. Bosworth, iii, 118
McLean, Stafford, iv, 244
Mackechnie, Hugh Neil, ii, 26
Magnesium sulphate in biliary drainage, i, 219
Malarial spleen, i, 271
Mead, Sterling V., iii, 1 ; iv, 257
Mediastinal pleurisy, ii, 140
syndrome, ii, 136
Mediastinitis, syphilitic, ii, 138
Mediastinum, abscess of, ii, 139
anatomy of, ii, 127
dermoid cyst of, ii, 140
hydatid cyst of, ii, 140
malignant tumors of, ii, 127
Medical profession, preparing it to care for cases of mental traumata, iv, 1
welfare work, department of, iv, 1
Medicinal plants, cultivation of, iii, 165
Medicine, on the use of motion pictures in, iii, 199
Meltzer-Lyon test in gall-bladder disease, i, 261
Mental examination of feeble-minded children, iii, 140
traumata, iv, 1
Microcephalic type of feeble-minded children, iii, 135
Milk, albumin, in nutritional disorders, iv, 96
Miller, T. Grier, i, 176
Minot, George R., i, 39
Mitral regurgitation, i, 92, 94
stenosis i, 92, 94
Molcho, M., ii, 187
Mondor, Henri, ii, 267
Mongolian type of feeble-minded children, iii, 135
Moron, definition of, iii, 121
Morrison, Theodore H., iii, 245
Motion pictures in medicine, iii, 199
Mucocele of appendix, iii, 303
Murmurs, heart, diastolic, iv, 176
Myocardial necrosis in hyperthyroidism, i, 183

N

Neck, cancer of, i, 124
Neoplasms of testicle, i, 168
Nephritis, blood in urine of, i, 199
chronic, nitrogen retention in, i, 201
hypertension in, i, 200
in childhood, i, 202
non-protein nitrogen in blood in, i, 201
protein diet in, i, 203
Nerves, transplantation of, iii, 63
Nervous gastric affections in old age, iii, 269
syndromes produced by lesions of the spine, iii, 220
system in syphilis, ii, 232
Neuritis and osteomalacia, ii, 219
Neurocirculatory asthenia in young women, i, 97
Neurodocha, iii, 233
Neurodocitis, iii, 232
Normal child, development of, iii, 132
Norris, George W., i, 24
Norton, N. R., iv, 231
Nutritional disorders albumin milk in, iv, 96
problems, department of, iv, 69

O

Obesity and diabetes, i, 176
Old age, gastric disturbances of, ii, 245
Ong, Harry A., iii, 230
Oral prophylaxis, iii, 46
sepsis, iii, 1 ; iv 257
Orbit exenteration of, iii, 293
Os trigonum, injury of, i, 142
Osteoarthritis of the spine, iii, 232
Osteomalacia, age and sex and, ii, 190
case reports of, ii, 191, 208
climate and, ii, 187
clinical forms of, ii, 215
damp dwellings and, ii, 189
diagnosis of, ii, 218
etiology of, ii, 188
food and, ii, 188
heredity and, ii, 189

Osteomalacia, histology of, ii, 197
in childhood, ii, 187
neuritis and, ii, 219
pathogenesis of, ii, 198
pathology of, ii, 193
symptomatology of, ii, 204
treatment of, ii, 223
Osteomyelitis, i, 246
of calcaneum, i, 152
pyogenic, of the spine, iii, 222
Ovarian disease and goitre, ii, 110
Ovary, transplantation of, iii, 66
Owen, W. O., iii, 199

P

Paediatrics, department of, i, 101; ii, 187; iv, 223
Pain, relief of, in malignancy, by alcoholic injections, iii, 287
Palate, hard, incomplete union of, ii, 265
Pancreas disturbances of, i, 264
Paralysis agitans and lenticular degeneration, i, 76
Paralytic type of feeble-minded children, iii, 135, 139
Pardee, Irving, iv, 223
Parkinsonian syndrome and epidemic encephalitis, i, 79
Pelvic abscess, i, 266
infections, ii, 36
organs, visualization of, ii, 44
Perfume-yielding plants, iii, 194
Periapical diseases, iii, 10
Pericarditis, suppurative, i, 284
Peridontal disease, iii, 14
Peridontoclasia, iii, 17
Peritoneal cavity, injected with carbon dioxide gas, ii, 44
Pernicious anæmia, i, 8, 39, 186, 272
soreness of tongue, an inaugural symptom of, iii, 217
Pharmaceutical research, iv, 203
Piersol, George Morris, i, 86
Plants, breeding of, iii, 193
cancer of, iii, 164
medicinal, cultivation of, iii, 165
Plastic eye surgery, epidermic graft in, iii, 292
Pleurisy, mediastinal, ii, 140
Pollock, Lewis J., i, 67
Polycythæmia, i, 194
Polyglandular deficiency, iv, 223
Potassium chloride as a diuretic, i, 203
Pregnancy, extra uterine, ii, 17
etiology of, ii, 22
symptoms of, ii, 21, 24
Progress of medicine, i, 176
of surgery, i, 241
Prolapse of rectum, ii, 294
Prostate, i, 289
cancer of, i, 291
hypertrophy of, i, 290
Protein, artificial, i, 64
natural, i, 64
sensitiveness, i, 64
Proteins, anaphylactic shock due to, i, 64
foreign, relation of, to disease, i, 56
Pseudosclerosis *vs.* Wilson's disease, i, 74
Psychoneuroses, therapeutics of, iv, 207
Pulp tester, iii, 40
Pyelitis in children, i, 101
catheterization in, i, 110
diagnosis of, i, 108
etiology of, i, 104
pathology of, i, 107
prevention of, i, 113
symptomatology of, i, 107
treatment of, i, 111
Pyloric stenosis, i, 255
Pyonephrosis, ii, 12

Q

Quinidin in auricular fibrillation, i, 197

R

Rachitic child and bronchial infections, ii, 239
Rackemann, Francis M., i, 56
Radiography in hydatid disease, ii, 85
Radium for cancer of breast, i, 276
in apparently hopeless cancer cases, i, 122
treatment of angioma by, iv, 244
Rectum, cancer of, ii, 267
complications of, i, 147
diagnosis of, i, 146
etiology of, i, 145
in children, i, 149
prolapse of, i, 144; ii, 294
symptoms of, i, 145
treatment of, i, 147
Reduction in death-rate of cancer, iii, 163
Renal calculi, i, 289; iv, 246
Research, pharmaceutical, iv, 203
Respiratory infections, etiology of, iv, 123
Rheumatic fever, i, 1, 233
heart in, i, 1
treatment of, i, 1
Rhinitis, vasomotor, i, 59
Rhino-laryngologic phases of harelip, ii, 258
Rickets, ii, 239; iii, 209
Riesman, David, iii, 217
Robertson, William Egbert, iv, 78
Röntgenograms in diagnosing oral sepsis, iv, 257
Rolleston, Humphry, iv, 108
Roquet, Eugène E., i, 152
Rupture of lung, ii, 10

S

Sarcoma of heel and groin, i, 126
of wrist, i, 123
primary, of the spine, iii, 228
Scherer, C. A., ii, 244
Schick test, iv, 151
School children, guarding the eyesight of, iv, 31
Selinger, Maurice A., ii, 230
Sepsis, oral, iii, 1 : iv, 257
Shell shock, iv, 218
Shock, iii, 73
Shoulder, angio-sarcoma of, i, 123
Sippy treatment of gastric ulcer, i, 212
Skin tests with foreign proteins, i, 56
transplantation of, iii, 65, 292
Smears, wound, iv, 281
Smukler, M. E., iv, 31
Social workers, what they should know about medicine, iv, 40
Sociological experiment in treatment of heart disease, i, 15
Sodium citrate for thrombo-angitis obliterans, i, 275
Soreness of tongue, inaugural symptom of pernicious anæmia, iii, 217
Speech, delay in acquisition of, iii, 147
Speese, John, i, 241
Spine, benign tumors of, iii, 232
lesions of, producing nervous syndromes, iii, 220
osteoarthritis of, iii, 232
pyogenic, of, iii, 222
sarcoma, primary, of, iii, 228
Spleen, i, 268
chronic sepsis of i, 270
in anæmia, i, 268
malarial, i, 271
rupture of, i, 272
syphilis of, i, 270
Splenectomy, i, 188, 268, 272
Splenic anæmia in children, i, 271
Splenomegalia, chronic, i, 271
Sporadic goitre, ii, 108
Steel, Wm., iv, 295
Stigmata of degeneracy, iii, 134
Stomach, anatomy of, i, 204
cancer of, i, 214
of, in old age, iii, 259
contents, i, 205
dilatation of, in old age, iii, 261
disturbances of, i, 204
hour-glass, i, 255
physiology of, i, 204
syphilis of, in old age, iii, 250, 263
tumors, i, 213
ulcer of, in old age, iii, 257
Stone in the kidney, iv, 246
Stools in new-born, breast-fed infants, i, 114
Strauch, August, iv, 96
Streptococcus infection of uterus, ii, 38
of tubes, ii, 38
Stuttering, iii, 149
Substernal goitre, i, 182, 283
Surgery, chest, some newer aspects of, iii, 27
Swan, John M., iv, 176
Symblepharon, iii, 299
Syphilis, cardiovascular, iv, 131
congenital, ii, 230
gastric ulcer and, i, 208
intravenous treatment of, ii, 234
nervous system in, ii, 232
symptoms of, ii, 234
of liver, fever in, i, 220
of mediastinum, ii, 138
of spleen, i, 270
of stomach in old age, iii, 250, 263
of testicle, i, 163

T

Talley, James E., ii, 1
Teeth, care of, iii, 51
extraction of, iii, 7
impacted, iii, 8
Testicle, ectopia of, i, 160
epithelial neoplasms of, i, 168
lymphadenoma of, i, 165
malignant diseases of, i, 172
pathological processes of, i, 160
syphilitic fungus of, i, 163
transplantation of, iii, 67
undescended, i, 160
complications of, i, 162
Tetanus, i, 285
Tetany, chronic, iv, 225
Thom, Burton Peter, iv, 131
Thomas splint, attachment for, iv, 302
Thoracotomy for hydatid cysts of lung, ii, 90
Thorax, neo-natal, ii, 240
Thrombo-angitis obliterans, i, 275
sodium citrate for, i, 275
Thymic region, malignant tumors of, ii, 127
Thymus, malignant tumors of, ii, 133
origin of, ii, 133
Thyroid disease, i, 180, 280
in young women, i, 96
iodine for, i, 280
malignant tumors of, i, 283
transplantation of, iii, 55
Tongue, cancer of, i, 249
soreness of, inaugural symptom of pernicious anæmia, iii, 217
Toxin, shock, iii, 86
Transplantation of organs, iii, 54
Transverse lesions of the cord, iii, 220
Traumata, mental, iv, 1
Traumatic asphyxia, ii, 10

Tuberculosis, bone, i, 246
bronchial gland, ii, 102
carbon dioxide and, i, 230
dust and, i, 230
of fallopian tubes, ii, 36
of the vertebræ, i, 226
pulmonary, i, 226
auto-urine test in, i, 226
basal lesions in, i, 231
complement fixation test for, i, 228
eye sign in, i, 228
phrenic sign in, i, 229
treatment of, i, 232
tracheo-bronchial, ii, 138
Tuberculous adenopathies, ii, 138
Tumors of breast, i, 276
of brain, il, 251
of fourth ventricle of brain, ii, 93
of mediastinum, ii, 127
case reports, ii, 142
classification of, ii, 132
diagnosis of, ii, 137, 138
etiology of, ii, 133
morphology of ii, 130
onset in, ii, 135
origin of, ii, 129
pathology of, ii, 129
prognosis of, ii, 141
relation of age and sex, ii, 134
symptomatology of, ii, 134
symptoms of, ii, 136
treatment of, ii, 141
of spine, iii, 232
of stomach, i, 213
of testicle, i, 168
of thymus, ii, 127, 129
origin of, ii, 133
pathology of, ii, 129
Turck, Fenton B., iii, 73
Turnbull, Hubert M., ii, 93
Typhoid fever, i, 224
infection and the biliary tract, iii, 239
vaccination in, i, 225

U

Ulcer, duodenal, i, 250; iii, 257
gastric, i, 207, 250; iii, 257
varicose leg, treatment of, iv, 295
Umbilical hernia, ii, 7
Uræmia, relation of urea to, i, 202
Ureteral stone, ii, 12
Urine, albumin and casts in, importance of, i, 198
blood in, in nephritis, i, 199
lipoids in, i, 199
Urticaria, i, 62
Uterine disease and goitre, ii, 110
Uterus, streptococcus infection of, ii, 38

V

V. D. clinic of the Edinburgh Royal Maternity Hospital, iv, 9
Varicose leg ulcer, treatment of, iv, 295
Vasomotor rhinitis, i, 59
Vermiform appendix, mucocele of, ii, 303
Vertebræ, tuberculosis of, iii, 226
Vertebral funiculitis, iii, 232
heteromorphisms, regional, iii, 236
malformations, congenital, iii, 234
Visceral arterio-sclerosis, iii, 270
Vitamin A, iv, 70, 78
B, iv, 70, 78
C, iv, 70, 78
D, iv, 70, 78
Vitamins, comments concerning, iv, 78
Voegelin, Samuel, iv, 281
Von Jaksch's disease, i, 271

W

Walsh, James J., iv, 207
Wassermann reaction, ii, 232
Watson, Leigh F., ii, 7
Weber, F. Parkes, ii, 93
Wheeler, John M. iii, 292
Williams, Philip F., i, 114
Wilson's disease, i, 67, 70
pathology of, i, 73
pseudosclerosis and, i, 74
symptoms of, i, 71
Women, gonorrhœa in, ii, 38
young, heart lesions in, i, 86
Woolston, Wesley J., ii, 36
Word-deafness, congenital, iii, 145
Work, Hubert, iii, 163
Wound smears, iv, 281
Wrist, sarcoma of, i, 123

X

X-ray burns, iii, 34
X-rays for cancer, i, 279
nomenclature of, iii, 30

R
11
I6
ser. 32
v. 4

International Clinics

Biological
& Medical
Serials

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY

STORAGE